The Electrical Industry's Weekly Magazine

March 2, 1959

Electrical World

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A McGraw-Hill Publication

75th Year

1884 1959

WINTER GENERAL MEETING

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STEVENS RICE GS W
UNIVERSITY MICROFILMS I
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Let Texaco help you achieve LOWER COST PER Kwhr

Texaco's long experience in dealing with every phase of power plant lubrication has resulted in a series of lubricants designed to meet the special problems encountered by electrical system engineers. Furthermore, Texaco Lubrication Engineers are always available to lend their special skills in routine as well as emergency situations. Let them help you keep your cost per Kwhr low.

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   - Coal processing and handling equipment
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2. **Experienced engineering service:**

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LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

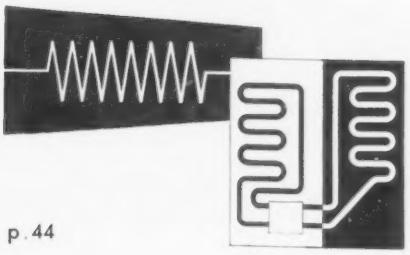
(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Electrical World

Vol. 151, No. 9 MARCH 2, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



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Atom Power Hearings Off to Heated Start

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Electric Heat Holds Up In Rough Winter

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What's On the Supervisor's Mind?

Utility supervisors have some pretty definite ideas about their own responsibilities, a nationwide survey shows..... p 78

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Engineering Highlights from AIEE Meet

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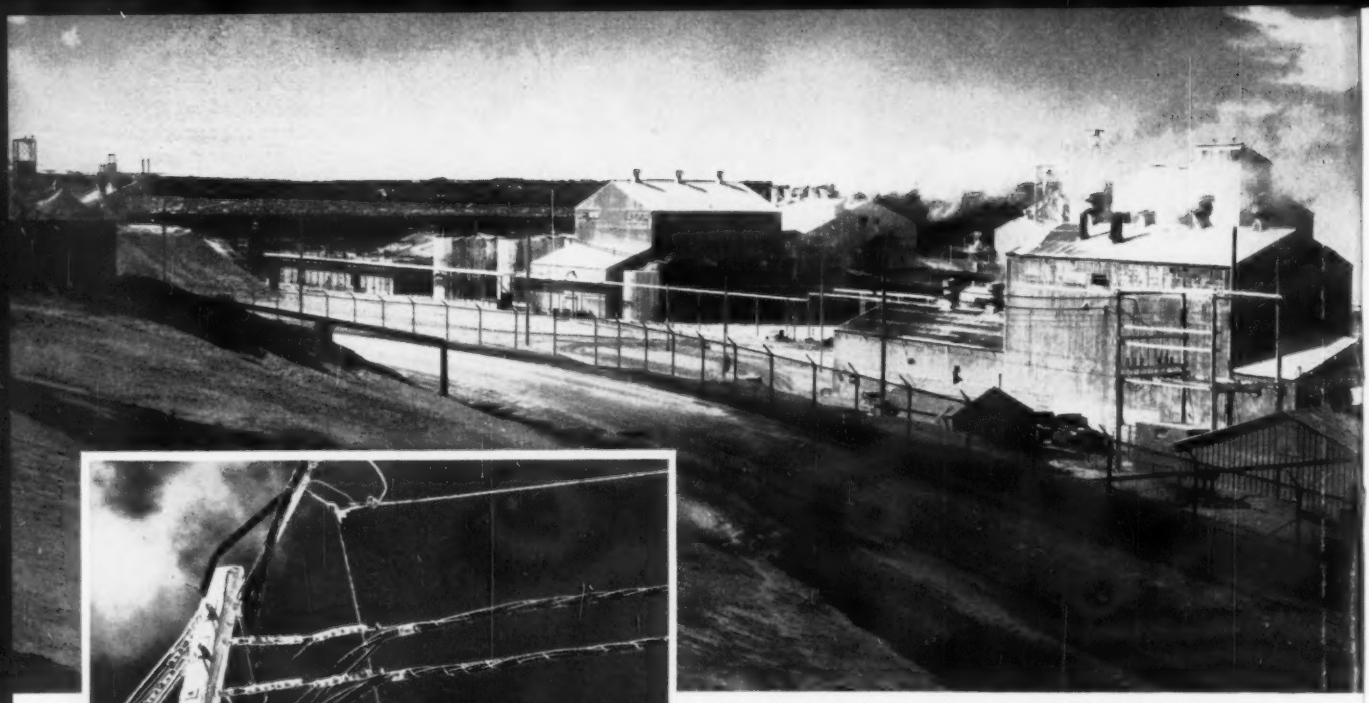

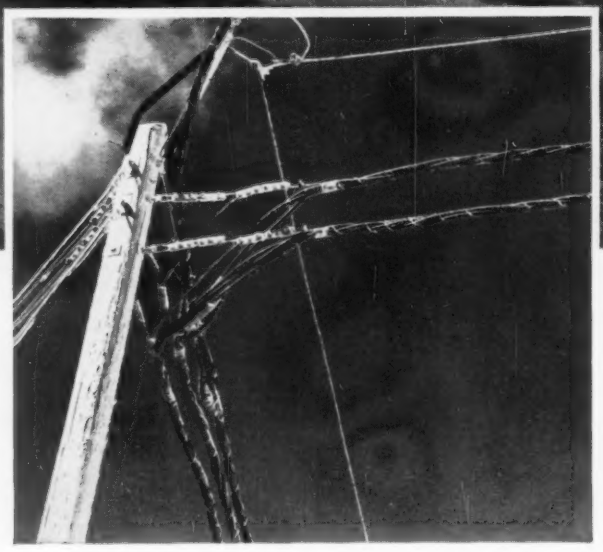

As the power goes . . . so go the operating costs at Intermountain Chemical Co.'s highly mechanized mining and refining operation. And every bit of this power—for digging, hoisting and processing of the ore—comes from Intermountain's power plant through 5kv non-shielded Okolite-Okoprene self-supporting aerial cables. They needed utmost dependability—and got it!

Heavy concentration of corrosive soda ash dust and severe environmental conditions have no effect at all on this aerial cable. Note the simple, low-cost support pole—no cross-arms needed—as well as the easy installation and splicing procedures used for this light weight, unshielded 5kv cable.

Okolite-Okoprene Aerial Cables withstand chemical contamination . . . assure continuous production at Intermountain

"These 5,000-volt aerial cables have withstood heavy concentrations of soda ash dust for eight years now," says Louis Ruffini, staff assistant to the maintenance superintendent for Intermountain Chemical Company of Wyoming. "They've proved to be invulnerable to temperatures as low as —40°F and as high as 120°. They've faced winds up to 70 mph, and they tested perfectly at 40,000 volts d-c. We expect them to be around a long time yet."

These facts are vital to Intermountain. The company depends almost completely on electrical power to mine trona ore and refine it into almost half a million tons of soda ash per year. That's why they stress the dependability of their Okolite-Okoprene, 3/c, self-supporting power cables with aluminum conductors, cables that distribute power to every sub-station in the mine and processing plant.

"Installation of the aerial cables was very simple," says Mr. Ruffini, "thanks to their flexibility, light weight, and self-supported Dualay construction . . . and due also to the unshielded 5,000-volt construction that permitted the simplest of splicing and terminating procedures."

For *your* power needs, this construction can offer installation and operating economies, combined with long-term dependability. Okolite insulation has a 30-year record of service, maintaining in severest installation conditions its high dielectric strength and great resistance to corona cutting, moisture and heat. Okoprene sheath offers unusual protection against weather, abrasion, ozone, heat, cold, many acids, alkalies and chemicals. Application by the strip process of both insulation and sheath is the final assurance of matchless performance and long life. For the Okolite-Okoprene self-supporting aerial cable that best suits your needs, see 56-page Bulletin EW-1074. It's free . . . just write The Okonite Company, Passaic, N. J.

***where there's electrical power . . . there's* OKONITE CABLE**

6216

Rates That Promote All-Electric Living

Ten years ago when Electrical World sponsored the first electric space heating conference, the outlook for ultimate success in this area seemed very dim indeed. At that time there was a strong trend toward higher and higher trailing rates and wider application of demand charges for residential customers.

It was some time before the rate engineers were stopped in this headlong drive toward penalty factors in rate-making. We understand the philosophy which caused them to go in the direction in which they were headed. It was one based on the profitability of individual appliance loads—rather than on the combination of all-electric use.

Fortunately the tide has turned. Trailing rates are coming down. The demand charge is losing its charm. New heating rates are being set between 1.2 and 2.0 cents per kwhr. These rates are proving adequate for promotion of space heating. And there is ample evidence that gas rates will move up to make the electric rates even more competitive.

We congratulate the utilities that have adjusted rates as a part of the all-out promotion of all-electric living. We hope the holdouts will come into line.

Fischer Black

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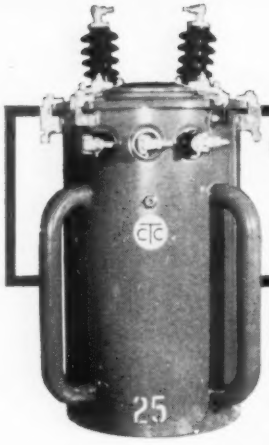


CENTRAL TRANSFORMERS GIVE
Better Performance
because...

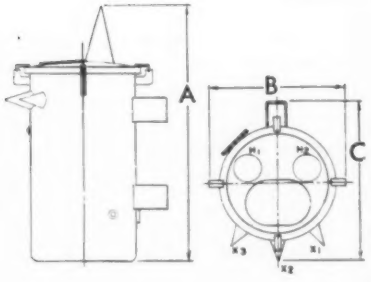
The NEW "H" CORE

...ASSURES YOU THAT CENTRAL TRANSFORMERS FEATURE...

- ✓ Lower Losses
- ✓ Lower Exciting Current
- ✓ Lighter Weight
- ✓ Smaller Size

Central's new "H" CORE is precision-wound on special machines designed and built to Central's specifications. This small, compact core assures a more efficient utilization of the magnetic properties of grain oriented steels. The efficiency of the "H" core is further enhanced by Central's new and improved annealing process. The smaller core also has permitted improvements in the design of the coil and other components—all of which adds up to transformers that give . . .
BETTER PERFORMANCE!

EXAMPLE: Central's 25KVA 7620/13,200Y to 120/240, no taps.



MECHANICAL DATA	1957	1959
A —	42 in.	40 in.
B —	25 in.	21 in.
C —	26 in.	26 in.
Weight	535 lbs.	490 lbs.

ELECTRICAL DATA (Average Tested Values)

20% REDUCTION in No Load Loss
8% REDUCTION in Total Loss
18% REDUCTION in Exciting Current

JUST ONE MORE REASON WHY CENTRAL TRANSFORMERS ARE **PREFERRED** THROUGHOUT THE NATION

CENTRAL CTC

Sales Offices in Principal Cities
Transformer Corporation
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PINE BLUFF, ARKANSAS

NEMA

PEABODY'S COAL RESERVES

could power New York City's television sets for 1,644 years

Yes, Peabody's Coal Reserves, if used to generate electricity, could power New York's television sets for 1,644 years. They are large enough to completely light and power the city of Chicago for 200 years. What does this mean to you? It means a *dependable* source of fuel from Peabody's huge reservoir of more than two billion tons of coal. A continuous acquisition program of productive mining properties . . . economically accessible to the nation's inland waterways and rail facilities . . . assures Peabody customers long-term high-productivity and diversified selection. May we be of service to YOU?

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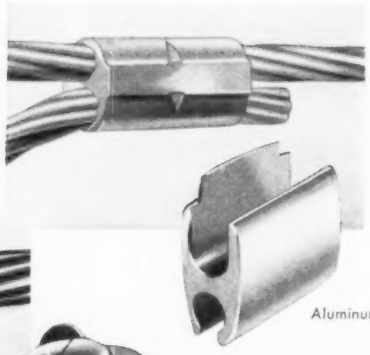
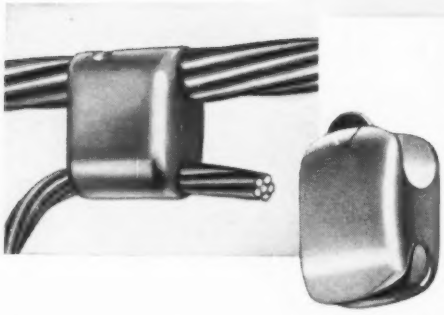
KEARNEY

today's

tomorrow's loads demand

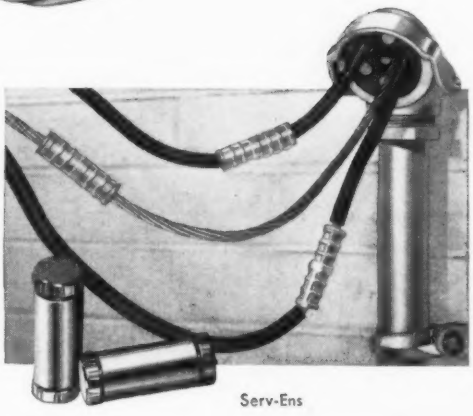


Aluminum Squeezons

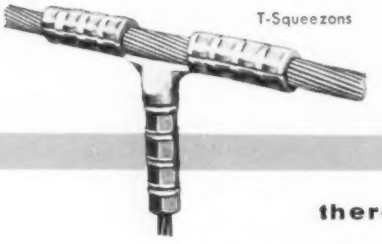


Copper Squeezons

Tension Splicing Sleeves
and Jumper Sleeves



Serv-Ens



T-Squeezons

there's a KEARNEY compression fitting for almost every

Insulated Splices

Bolted Jumper Sleeves

Compression
Terminals

L-Squeezons

L-Squeezon Stirrups

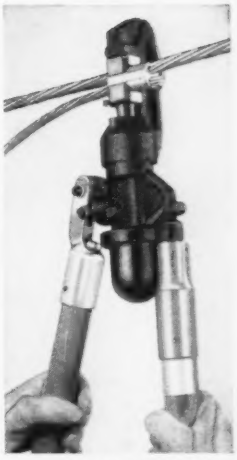
Ground Rod Fittings

Ground Lugs

for better construction – safer maintenance –

KEARNEY compression fittings

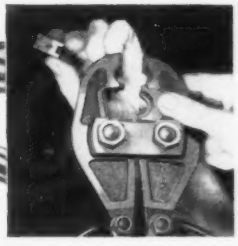
Solve distribution system connection problems with Kearney Compression Fittings . . . get lasting, dependable connection performance under the most rugged operating conditions. Kearney Compression Fittings assure uniformly correct contact pressure, eliminate burndowns and insure extra-long connection life in severely contaminated atmosphere. They prevent contact surface corrosion, eliminate loose or unreliable connections . . . reduce costs. Consider the advantages and economy of Kearney Compression Fittings; write or ask our field representative for more information.



Kearney WH-1 Hydraulic Tool

Fast . . . powerful . . . easy to use. From wide open dies to full compression in less than 20 strokes. Twist of the wrist retracts die or sets tool to make compression. Narrow head for full visibility of work area. Balanced weight for easy positioning. Interchangeable handles available for hot line work.

...applied with KEARNEY compression tools



Dies may be easily snapped in or out with fingers only

KEARNEY TYPE O MECHANICAL TOOL

Almost every distribution connection can be made with this ONE lightweight, inexpensive tool. In addition to installing more sizes and types of fittings than tools with fixed dies, the Kearney Type O Mechanical Tool is faster, easier and safer to use. Rugged construction throughout—no complicated parts. Forged steel head, heat treated for high strength. Nose die compresses Serv-Ens and L-Squeezons. Fourteen interchangeable dies cover a wide range of connection fitting jobs.

connection requirement

Compression Deadends

Serv-En Adapters

these 3 easy steps insure trouble-free electrical connections:

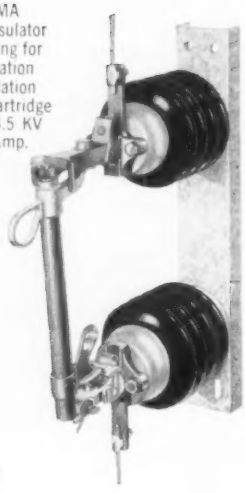
1. Use Kearney Conductor Cleaning Brush to remove corrosion.
2. Apply Kearnalex to aluminum contact surfaces immediately after cleaning to exclude air and moisture . . . maintain maximum efficiency contacts.
3. Seal the connection against moisture and contaminants with Kearney Airseal.

specify KEARNEY compression tools and fittings

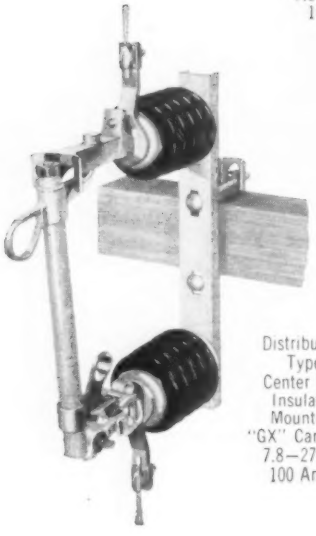
KEARNEY

KEARNEY "G" and "GX"

TYPE GX
Tripout
Fuse Cutout
7.8—27 KV
100 Amp.



NEMA
Post Insulator
Mounting for
Substation
Installation
"GX" Cartridge
7.8—34.5 KV
100 Amp.



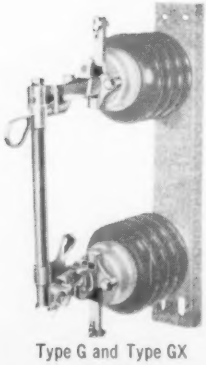
Distribution
Type
Center Bolt
Insulator
Mounting
"GX" Cartridge
7.8—27 KV
100 Amp.

Type "GX" Cartridges vent at bottom only on low-amperage faults . . . at both ends on high fault currents. Both vents are in line with axis of tube, reducing shock recoil to a minimum. On high amperage faults, top venting action blows small disk out of expendable cap to safely relieve gas pressure.

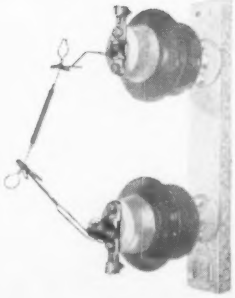
UPDATE YOUR OLDER CUTOUTS WITH KEARNEY CONVERSION UNITS

These modern current-carrying parts install on existing mountings to give you all of the outstanding features and performance of the newest Kearney Cutouts—positive dropout action, higher interrupting capacity, and extra strength fuse tubes.

Type G 5.2-15 KV
Type GX 7.8-15 KV



Type G and Type GX
7.8-34.5 KV



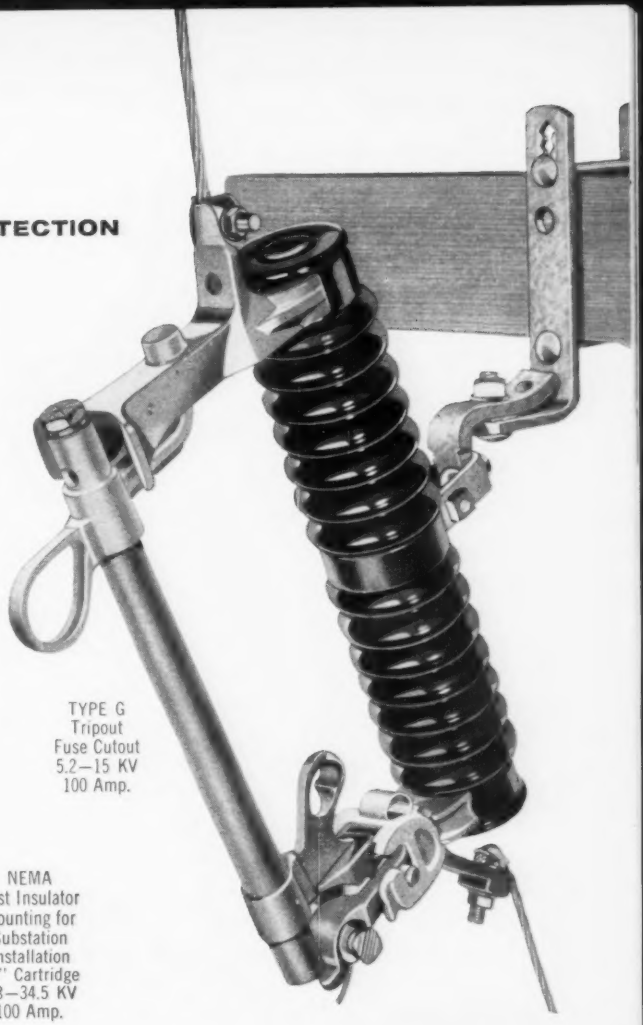
Trip-O-Link 50 Amp.
23-69 KV

for better construction – safer maintenance – specify KEARNEY products

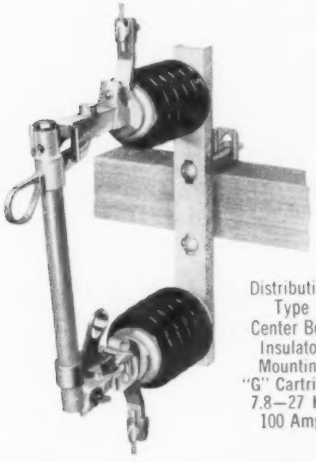
cutouts...

FOR DEPENDABLE, MODERN SYSTEM PROTECTION

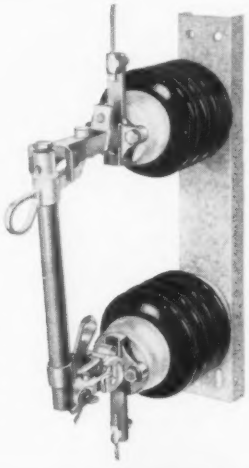
Kearney Type "G" and "GX" Tripouts assure the highest level of operating dependability and economy for full range distribution system protection. Both interrupt fault currents ranging from minimum melting of the link to maximum rating of the cutout with any size button head link up to 100 amperes. A choice of venting is offered by two cartridge types, interchangeable in the same voltage ratings. Full-time double venting is provided by the "G"... and pressure-controlled double venting by the "GX." These two cartridges, and a wide range of interrupting ratings, voltages and mountings meet every operating requirement.



TYPE G
Tripout
Fuse Cutout
5.2—15 KV
100 Amp.



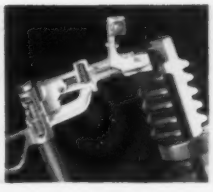
Distribution
Type
Center Bolt
Insulator
Mounting
"G" Cartridge
7.8—27 KV
100 Amp.

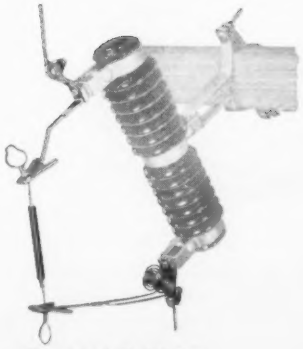


NEMA
Post Insulator
Mounting for
Substation
Installation
"G" Cartridge
7.8—34.5 KV
100 Amp.

Front vent directs expulsion gases away from line equipment. Gas pressure from top jet keeps cartridge in place and upper contacts closed until arc is extinguished. Size of top vent in double vented cartridge allows build-up of ample pressure to extinguish low amperage arcs, yet enables cartridge to withstand gas force of high current faults without rupturing.

Heart of Type "G" construction is this full-floating constantly aligned upper contact, which cannot be misaligned by high current interruption or extreme side thrust during closing. During interruption, force of cartridge thrust is absorbed by full-floating contact until arc is extinguished and cartridge drops out.

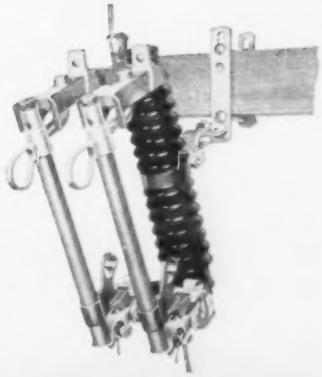




Trip-O-Link 50-100 Amp.
5.2-15 KV

KEARNEY DUAL CARTRIDGE LOAD INTERRUPTER

Safe, positive way to interrupt load current. For full load sectionalizing or dropping transformer or capacitor banks. Current is interrupted electrically, not mechanically. During operation, one cartridge, fused for load protection, is closed in; the other, the interrupter, fused with a low amperage link, remains open. Later this cartridge is closed in, and service cartridge pulled out. After predetermined time delay, small link blows, interrupting current safely within interrupter cartridge.



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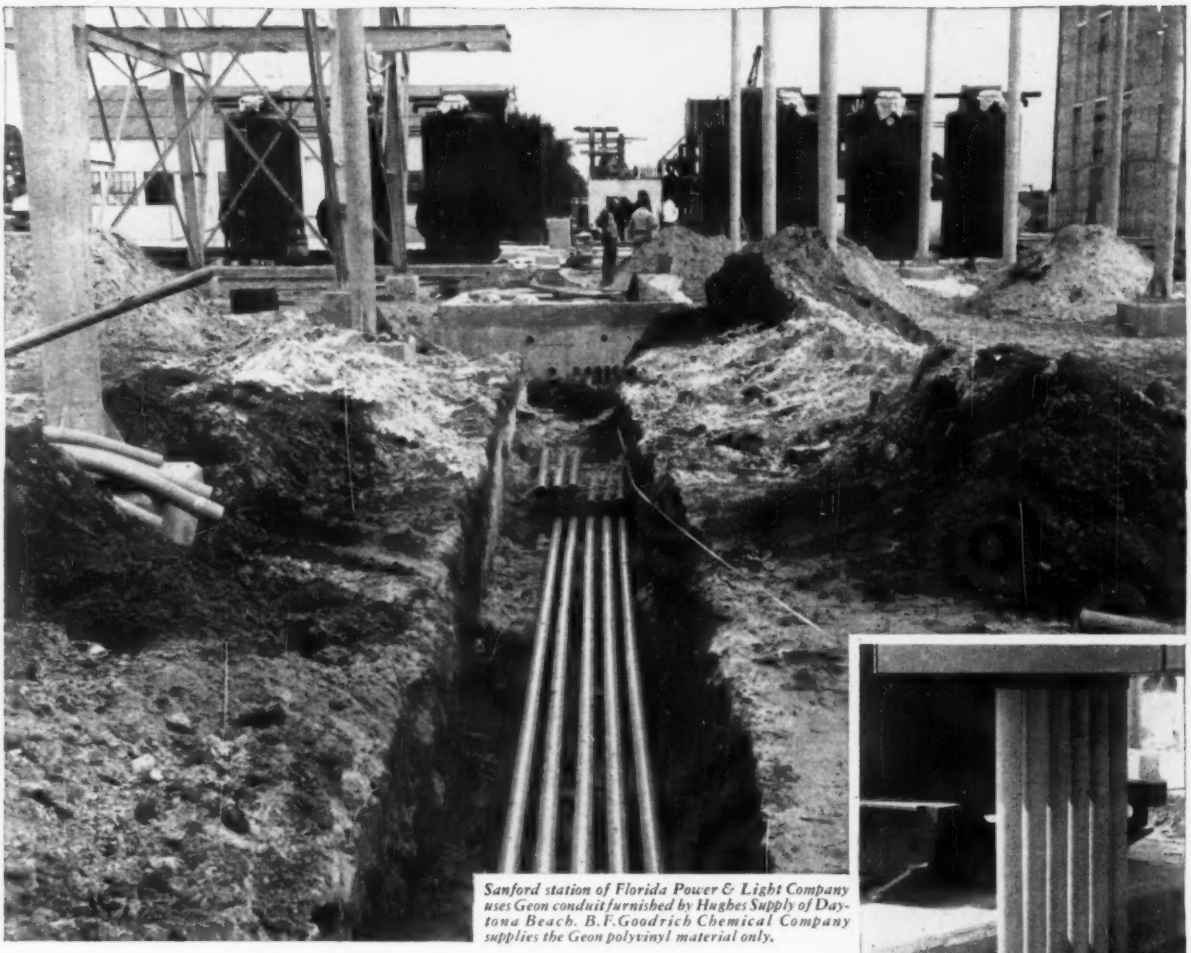
B.F.Goodrich Chemical *raw materials*



Sanford station of Florida Power & Light Company uses Geon conduit furnished by Hughes Supply of Daytona Beach. B.F.Goodrich Chemical Company supplies the Geon polyvinyl material only.

corrosion problem knocked out . . .

generating station gets conduit of Geon

YEARS from now pulling new cable through this conduit made from Geon polyvinyl materials will be just as easy as it is today. Unlike ordinary steel conduit, Geon conduit resists the corrosive effect of salt water, gases, chemicals and acid or alkaline soils. Internal and external surfaces stay smooth—like new.

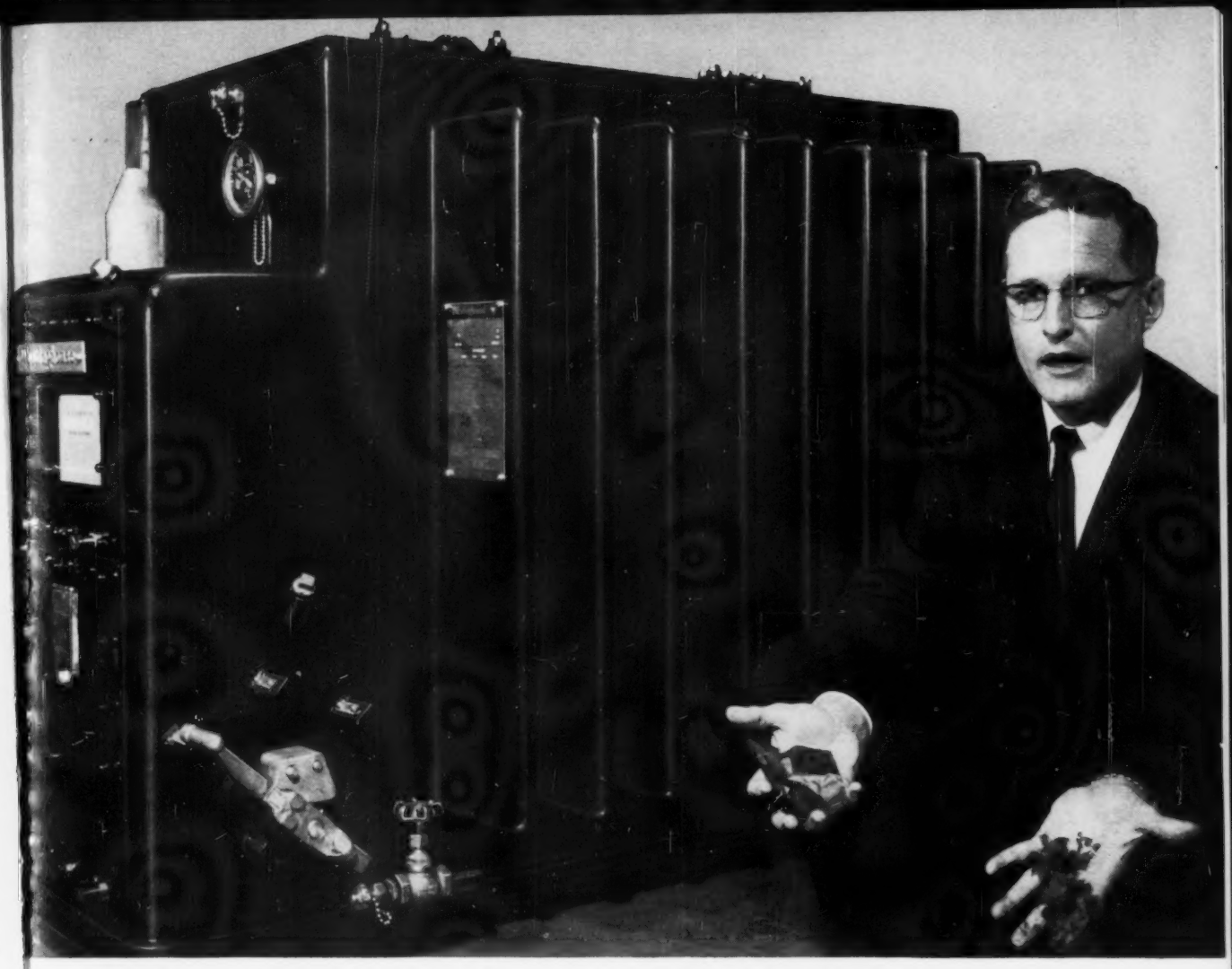
Conduit or pipe made from Geon offers high tensile or impact strength. It stands up under pressure . . . is not subject to galvanic corrosion. It resists sunlight, fungi, bacteria, moisture, heat and cold. And its light weight makes installation especially easy.

Engineers are taking advantage of properties of pipe and conduit of Geon in a wide variety of applications. For information, write Dept. AT-1, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors



The "Crumble Test" proves superior heat resistance of Westinghouse Insuldur-system insulation . . . J. C. Gardner, Westinghouse network transformer representative at the Sharon, Pa., plant, demonstrates how overload and summer heat can "kill" insulation in transformers without the Insuldur system . . . while Insuldur system "stays alive."

Higher ambients, same overloads...but no heat damage

WITH WESTINGHOUSE SPACE-MISER NETWORK TRANSFORMERS

Now . . . Insuldur system guards insulation life in Westinghouse Space-Miser network transformers

Heat is the major threat to transformer insulation life —whether from emergency overload conditions or high summer ambients.

The new Insuldur* insulation system now available in Westinghouse oil-immersed Space-Miser network transformers reduces the heat threat from both sources.

Now, higher emergency overloads can be carried without fear of shortening insulation life . . . because Westinghouse network transformers with the Insuldur system operate *safely* at temperatures up to ten degrees higher than previous safe temperature limits.

Summer heat wave problems are reduced, because load-carrying ability is assured for ambients up to ten degrees higher with the Insuldur system.

The Insuldur insulation system is a Westinghouse exclusive—no other network transformer has this positive insulation-life protection.

Westinghouse oil-immersed network transformers with the Insuldur insulation system retain dollar-saving flexibility . . . easy future change to Inerteen® should the need arise.

Ask your Westinghouse representative about the Insuldur insulation system . . . a "Bonus Value" from Westinghouse Plowback of Earnings into research.

*Trade-Mark

J-70898

YOU CAN BE **SURE**...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Another sound reason for buying J-M No.55 Cable Fireproofing Tape:

"It not only earned us praise –but saved our profit on a highly competitive bid!"

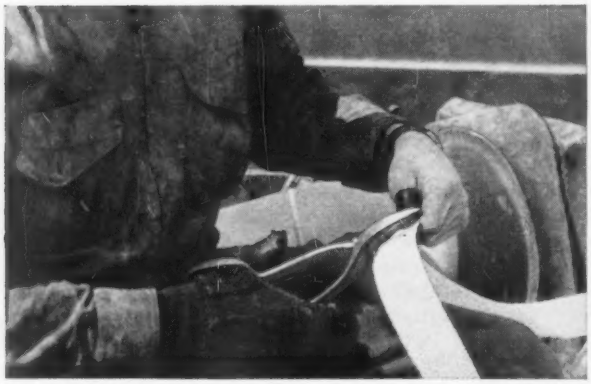
. . . states Mr. E. H. Lovette, President, Lovette Electric Construction Co., Durham, N. C.

"On one of our many military airfield installation jobs from Georgia to Iceland," states Mr. Lovette, "we had to pump out 78 manholes filled with water before starting our electrical work. This meant that the cables had to be wrapped in the shortest possible time to complete the job on schedule . . . and keep us out of the 'red'.

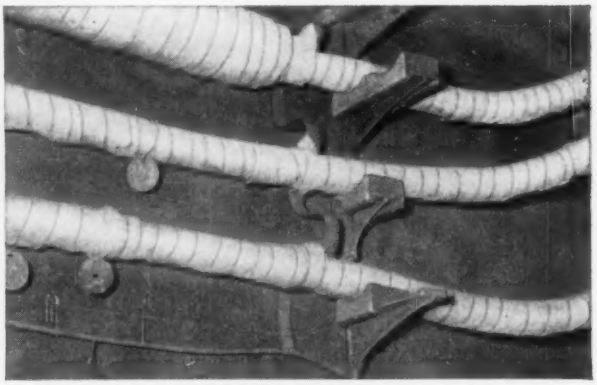
"Using two layers of J-M No. 55 Cable Fireproofing Tape, ½ lap, and tying them with copper wire, we only had to make one trip down each manhole. The savings in time and labor more than offset the slight additional cost of the J-M tape, and enabled us to come out with a profit.

"When a porcelain pot head blew up causing a fire at a switch gear station, the J-M No. 55-covered lead cable was practically unaffected though the fire melted the porcelain and copper. Engineering officers were so impressed that they asked us to use J-M No. 55 Tape on other jobs at their base."

It will pay *you* to use J-M No. 55 Cable Fireproofing Tape made of *asbestos* to defy fire. In an economical thickness, silicone impregnated, it repels corrosive waters and solvents. Write for Brochure TX-6A to Johns-Manville, Box 14, N. Y. 16, N. Y. In Canada: Port Credit, Ont.



No special labor skills are required to apply J-M #55 Tape. Special tools or training are not needed. Here a Lovette workman is cutting tape to protect cable in manhole at an important U. S. air base.



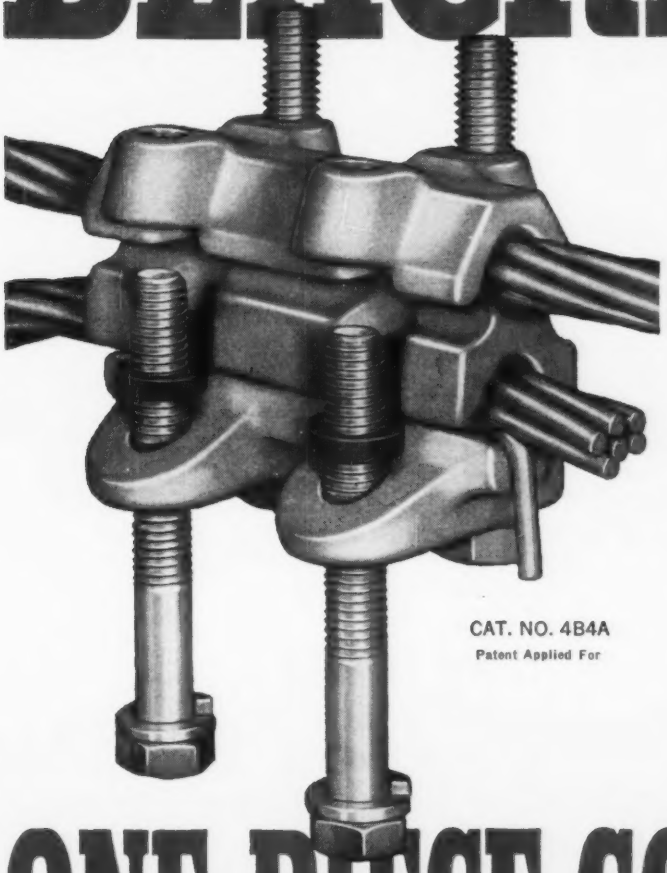
Finished job using J-M #55 Tape is neat, stays neat, resists fire and water. This Lovette manhole job, exposed to jet fuel, kerosene, diesel oil and other solvents during air base defueling operations, won praise from base officers.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

It's New! Installs quicker...easier

BLACKBURN



CAT. NO. 4B4A
Patent Applied For

It's here... a heavy duty one-piece 4-bolt connector with all the electrical and mechanical advantages of a U-bolt connector... yet much easier to install.

No bothersome nuts, washers, housings, spacer to take apart and assemble. Just three quick, easy steps and installation is completed.

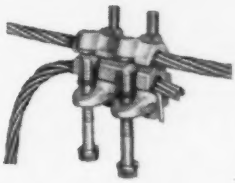
Housings are of non-copper-bearing aluminum alloy. Spacer of soft aluminum pig protects conductor, aids conductivity. Spacer treated with heavy coating of oxide inhibiting compound. Hardware is high strength aluminum alloy completely alumilited to prevent seizing.

WIDE RANGE...
Accommodates conductors—2/0 to 397.5 ACSR—3/0 to 477 MCM.

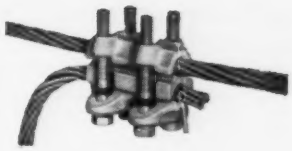
ONE-PIECE CONNECTOR

HERE'S HOW EASY THE NEW 4-BOLT CONNECTOR IS TO INSTALL

Unscrew the two free bolts contained with neoprene washers and hang over main.



Insert tap wire.



Tighten and you have the ultimate in a good connection.

Available through electrical wholesalers everywhere

JASPER BLACKBURN CORPORATION

1525 WOODSON RD., ST. LOUIS 14, MO., WYdown 3-9430

Both initial and periodic tree trimming are cut to an absolute minimum with Rome's preassembled aerial cable.

Fast, efficient installations, even in densely wooded areas, are possible with Rome's preassembled aerial cable.

Trim your tree-trimming costs with Rome's preassembled aerial cable

Stringing power lines, especially through wooded areas, need not be a time-consuming, expensive installation. Not if you use Rome's preassembled aerial cable.

Because of the staunch characteristics of preassembled aerial cable, both initial and periodical tree-trimming time is cut way down. Initially, you need not clear as much of a right of way for preassembled aerial cable as is necessary in the case of open-wire construction. Periodic tree trimming can be put off for as long as five years, in some cases. This is compared to a normal two-year requirement for open-wire construction.

In residential areas, tree trimming can be a problem. Home owners, who have an inherent interest in the trimming of trees which grace their property, are very interested in the amount of trimming that is necessary. When using Rome's preassembled aerial cable, it is not necessary to disturb the trees as much as in the case of open-wire installations.

In addition to the tree-trimming advantages of Rome's preassembled aerial cable, there are many other "reliability" factors which you get by specifying this particular type of cable installation.

Improved Voltage Regulation

Aerial cable, because of its close geometric spacing as compared with open-wire circuits, has a lower reactance. Voltage drop is about half as great as typical crossarm construction. Similarly, for a given allowable voltage drop, power can be transmitted twice as far.

Storm Protection

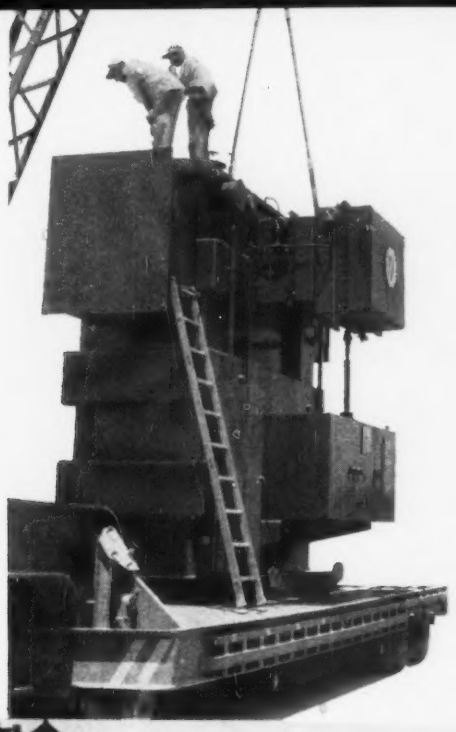
You can reduce your storm maintenance costs due to the strength of preassembled aerial cable. Falling branches, or even trees, can be supported by the cable itself.

Other features of Rome's preassembled aerial cable include (a) practicality of mid-span tapping (because of reverse-lay construction); (b) improved appearance (elimination of pole crossarm hardware, in many cases); and (c) simplicity of installation.

Use Rome's preassembled aerial cable the next time you have to extend your power distribution lines. Your job will be easier and you'll save labor and maintenance expense. For more information on this product, call your nearest Rome Cable representative—or write to Department 770-B, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

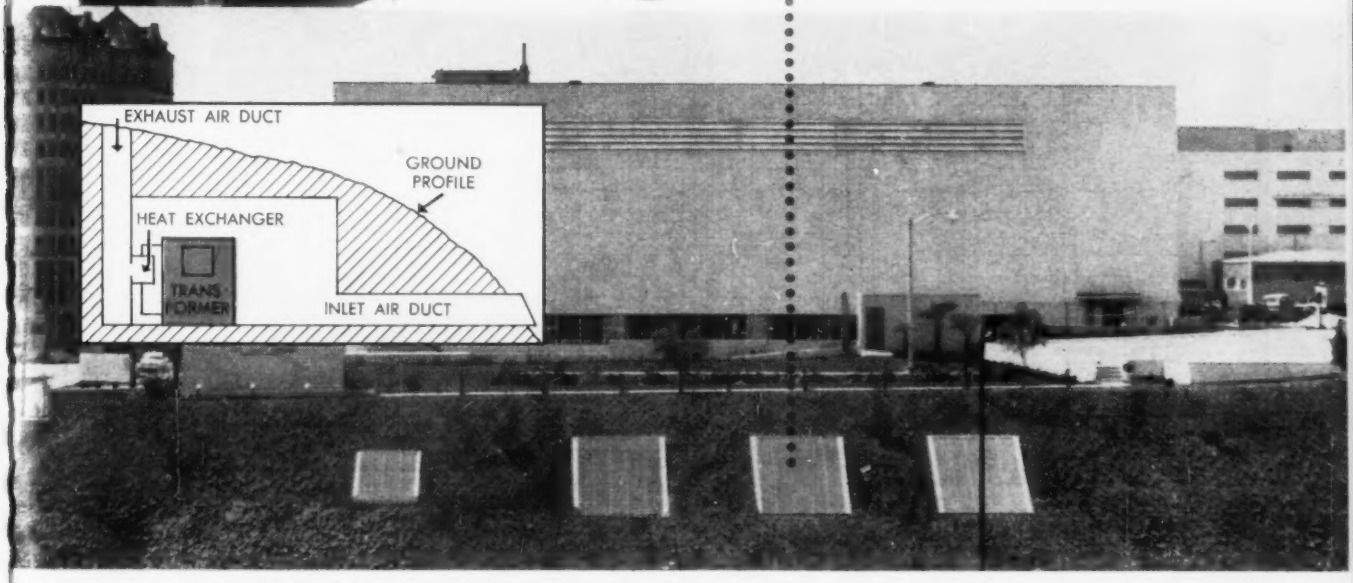


60,000 Kva

of Pennsylvania Transformer Capacity

GOES UNDERGROUND

in Los Angeles distributing station



Special cooling arrangement used in installation of three 20,000-kva load tap changing transformers

A combination of economic and esthetic factors prompted the City of Los Angeles, Department of Water and Power to construct an *underground* distributing station to supply power to the city's rapidly growing civic center. Studies indicated that an underground station would cost considerably less than a surface structure—particularly a surface structure that would harmonize architecturally with the large civic center buildings of the present and future.

Three 20,000-kva Pennsylvania Load Tap Changing Transformers are now "on the line" in this new underground distributing station. Despite space limitations, the transformers fit easily into their individual chambers—thanks to the compactness of Pennsylvania's new rectangular tank design. To solve the problem of cooling, transformer oil is pumped through flexible connectors to special oil-to-air heat exchangers (two for each transformer) that are sealed in the walls of outgoing air ducts. Air is drawn through inlet tunnels on the opposite side of the room, after which it passes around the transformer, through the heat exchangers, and into the outgoing ducts.

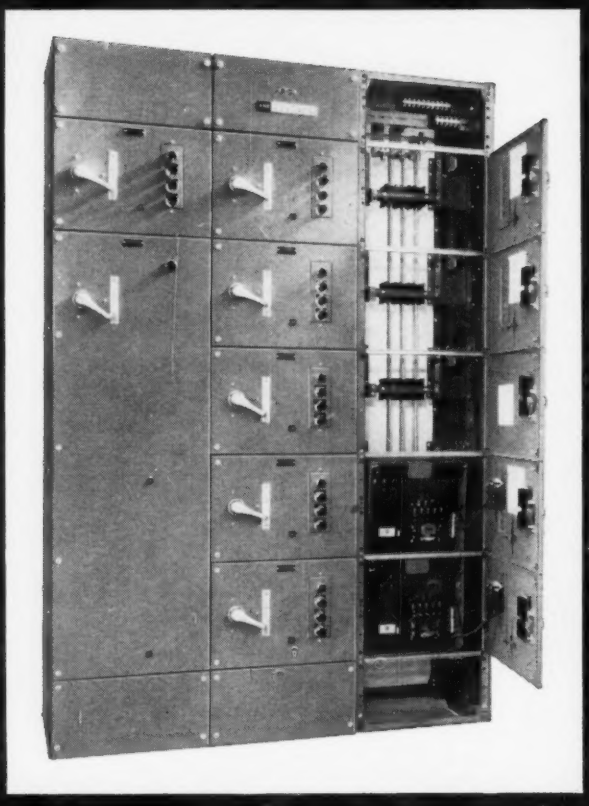
With more than thirty years of experience in the design and manufacture of power transformers, Pennsylvania can satisfy the usual as well as the unusual in installation requirements. For a discussion of your needs, contact Pennsylvania Transformer Division, Box 330, McGraw-Edison Company, Canonsburg, Pa.

McGRAW-EDISON

PENNSYLVANIA POWER TRANSFORMERS

In Control Centers...

Federal Pacific gives what you're looking for



RELIABILITY

BOLTED CONSTRUCTION – 11-gauge formed channels bolted together for maximum structure rigidity.

POSITIVE PLUG-IN CONTACTS – special beryllium copper alloy stabs provide high-pressure, low-resistance unit-connections to silver-plated bus.

TESTED TO WITHSTAND 25,000 AMP RMS SHORT CIRCUIT STRESSES.

FLEXIBILITY

PREPUNCHED STRUCTURES – for unmatched job flexibility...individual units or complete sections can be added, removed or interchanged to meet varying job requirements – present and future.

COMPACT DESIGN – up to 20 units can be mounted in a single vertical section.

EASY WIRING – oversize wiring spaces simplify initial installation and facilitate change of units.

SAFETY

UP-FRONT UNIT RELEASE – completely disengages unit from energized bus... can be locked in open position to prevent accidental contact.

FULLY ENCLOSED UNITS – steel barriers isolate each unit from adjacent parts.

DOORS MOUNT ON STRUCTURE – prevent accidental contact with energized bus when starter unit is removed.

Nothing has been left to chance in the design of this control center. Structure, starters, and protective devices have all been carefully engineered, manufactured and coordinated by Federal Pacific to assure the highest standard of operating efficiency and dependability—as well as to provide unified responsibility for performance. For complete details write for Bulletin 2-2000A, Federal Pacific Electric Company, General Offices: Dept. 305, Newark 1, New Jersey.

FPE

FEDERAL PACIFIC ELECTRIC COMPANY

The Best in Electrical Distribution and Control Equipment

The Electrical Week

FUTURE NEWS ▶ **Supreme Court decisions may not bode well for private utilities'** ECAP tax cases now before the FPC and IRS. The Court last week handed down decisions which said that liquor dealer's advertising expenses to defeat proposed state legislation were not necessary and proper business expenses, and therefore not tax deductible.

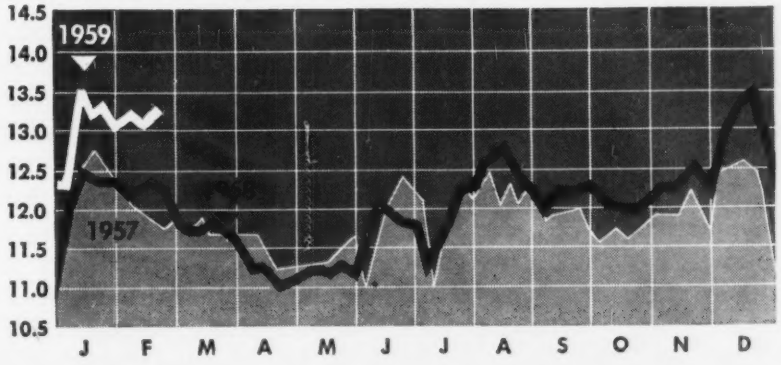
LATE NEWS ▶ **Washington Wire** . . . FPC is asked for preliminary permit to build 53,600-kw hydro dam across Hoh River by Washington Public Power Supply System, Kennewick, Wash . . . J. C. Linsenmeyer, American Radiator & Standard Sanitary vp, says his company plans to build prototype reactor for Wolverine Electric Co-op, Big Rapids, Mich . . . The White House may have trouble finding a TVA director to replace resigned Dr. Frank Welch. Difficulty is that appointment would be for only a year, and the position is controversial enough not to be attractive to most potential candidates.

Negotiations for merger of Rawlins Electric Co into Pacific P&L are now underway, says Pres D. R. McClung.

Rate hearings . . . Baltimore G&E says Baltimore Circuit Court has reversed rate base findings of Maryland PSC authorizing electric, gas and steam increases netting $4,422,000 a year. BG&E is now studying the opinion, and may carry case back to PSC or appeal to Maryland Court of Appeals . . . New Hampshire PSC rejects appeal for rate rehearing on a recent decision to grant Public Service of New Hampshire a $500,000 a year increase.

Management changes . . . El Paso Electric elects W. D. Burgess vp . . . Iowa Public Service names Marshall Hurd chief engineer . . . W. G. Reynolds and J. H. McConnell become executive vps of Reynolds Metals.

WEEKLY POWER OUTPUT—UP 7.5% (Week ending Feb. 21), Kwhr 13,259,000,000



Per Cent Change From Previous Year

	Feb. 7	Feb. 14.	Feb. 21
Total U. S.	+ 8.2	+ 6.0	+ 7.5
New Eng.	+ 8.4	+ 8.0	+ 9.7
Mid. Atlantic ..	+ 6.4	+ 4.5	+ 7.5
Cent. Ind.	+10.5	+ 7.1	+ 9.2
West Cent. ...	+12.0	+ 7.6	+ 6.4
Southeast	+ 2.1	— 2.1	+ 0.5
South Cent. ...	+12.3	+ 9.1	+ 9.0
Rocky Mount...	+14.2	+14.5	+13.7
Pacific			
NW	+10.8	+14.6	+14.7
SW	+10.6	+13.6	+13.0

Seasonally Adjusted Index 251.4

Week Ago 248.2 Year Ago 234.1

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Ike's private A-power development policies run into heavy fire** on Capitol Hill. Congressional Democrats are expected to come up with plans for government construction of reactors, but exact nature of their proposals won't be clear until after next month's AEC authorization bill hearings. McCone, in a major policy switch, says AEC will consider reactor capital-cost aid (p 42) . . . Electric heating passes severe winter tests with flying colors. Utilities report good performance, but admit to a few heat pump problems (p 44) . . . Rep C. M. Bailey (D—W. Va.), long-time public power supporter, startled the nation's Capital with his attack on TVA imports of heavy electrical equipment (p 46).

AIEE MEETING ▶ **AIEE marked its diamond anniversary** the week of Feb. 1 with the biggest Winter General Meeting in its history. Engineering highlights are summarized in a ten-page special report starting on p 47. Interest was high in organic moderators for nuclear reactors, (p 47), transmission vibration and structural problems (p 48), economic loading of distribution transformers (p 52), suggested revisions in substation design (p 50), gas insulation (p 54), semi-conductor rectifiers for industrial applications (p 55), progress in the use of digital computers (p 55), and power-line carrier relaying (p 52).

Politics and Public Power

A-POWER SUFFERS IN POLITICAL FEUD

Once again, the economic and political facts of life are dashing hopes for agreement on a power reactor development program acceptable to a Democratic Congress, the Administration, and the electric utility industry.

Everyone agrees generally what the goal should be: attainment of economic nuclear power in high-cost areas of the U. S. within ten years. But the hearings before the Joint Committee on Atomic Energy (see page 42) show a divergence of ideas on how to get there.

It's too early to say categorically that the widely heralded "honeymoon" between Congressional Democrats and John A. McCone, chairman of AEC, is over.

However, the ideological gulf appears so wide that perhaps it can never be bridged at the conference table, but only in the pulling and hauling of political combat.

Spokesmen for utilities and equipment firms long have agreed that a clear statement of government policy—endorsed both by AEC and JCAE—would remove much of the uncertainty that has plagued the infant industry. Accordingly, AEC and the Democratic-run Joint Atomic Energy Committee began negotiating for such an agreement more than a year ago, but bogged down in the feud between Democrats and Admiral Strauss.

McCone went out of his way to woo the Democrats. During the congressional recess last fall, he visited Democratic Sen Clinton Anderson, JCAE chairman. He embraced the Democratic idea that AEC should exercise closer control over projects.

Anderson made conciliatory moves, too. He praised McCone, soft-pedaled talk of large-scale government reactors and expressed hope that the public-versus-private power controversy could be avoided this year.

METHODS ▶ **Condenser tubes will be tested electronically** as well as visually and mechanically before they go into Consolidated Edison's Indian Point nuclear plant. Discussion on **p 57** . . . A composite design chart simplifies 161-kv transmission line design **(p 60)**.

MANAGEMENT ▶ **Utility supervisors speak their minds** about the management problems that confront them on the job. Chief among them is grass-roots human relations **(p 73)** . . . The utilities of Kentucky are setting a good example with their promotion of balanced area development for the state. Some of their accomplishments on **page 75**.

SELLING ▶ **"Oscars" go to Baltimore G&E and United Illuminating Co** as Look Magazine selects top promoters of adequate wiring . . . LBE slates the "biggest single magazine ad"—a 30-pager **(p 81)**.

MANUFACTURERS ▶ **Aluminum condenser tubes will go into a 75,000-sq-ft condenser** at West Penn Power Co's Armstrong Station . . . Kaiser cuts prices on aluminum rigid conduit **(p 62)**.

NEW EQUIPMENT ▶ **Cutout cover can be removed by hotstick,** provides protection in all weather . . . Recorder plots two different curves on same chart **(p 68)**.

Yet, McCone had been in the witness chair less than two days when this spirit of amity blew sky high. The cause: Rep Chet Holifield's action in distributing a press release, highly critical of the AEC program for fiscal 1960, before the AEC Chairman had even finished explaining it.

Chairman Anderson and several other committee members appear profoundly distressed by the turn of events; indeed, there are signs of efforts to heal the wounded feelings on both sides. However, it is an oversimplification to write off the incident as a mere emotional outburst growing out of Holifield's premature press release. After all, the Holifield statement was aimed at the Administration's program. It is a program which reflects President Eisenhower's determination to hold down government spending, and it reflects a sincere conviction that the government should not build even experimental prototype reactors unless private industry is unwilling or unable.

However praiseworthy this attitude, it is not one which Democrats feel they can accept. They believe that the government will have to construct the prototypes and perhaps even large-scale reactors before investor-owned utilities will be able to take over.

But the schism goes even further.

The Joint Committee believes it is the natural architect of atomic policies. Many AEC officials, however, think the committee actually tries to usurp powers constitutionally accorded to the executive branch.

As a result, the Democratic-run Congress is bound to vote a larger, more expensive reactor development program than the Administration wants. And the Administration is almost as certain to refuse to carry it out.

This state of affairs can be avoided only if the opposing sides can get together within the next month, when AEC bill hearings begin.

Highly enriched, gas-cooled reactor design boasts lighter weight, fewer components, and independence of local water supply compared with water-cooled reactor. A trailer-mounted unit of several hundred kw capacity is under development. **Nucleonics, January, 1959.**

TECHNICAL NOTES

Secondary arresters have eliminated system troubles that arose after lightning burned out the voltage coil on breakers used for switching capacitors.

Direct water cooling of conductors or slots is considered the only possible solution for turbogenerators with capacities exceeding 500 Mw.

Ratio of withstand voltage under impulse test conditions and nominal voltage is not constant for all types of power transformers. The generally used ratio of 2.3 must be tempered by the type of insulation.

Powdered copper and nickel have been successfully rolled in 0.05 to 0.06-in. thicknesses in widths up to 11 in. Powdered copper strip is said to have properties equal to those of electrolytic copper strip.

No problems of corona are reported for a 500-kv line built with three ACSR conductors of 540-mm² cross-section per phase.

Fly ash collected electrostatically should be kept separate from the coarser grades collected mechanically so that a premium product is available for concrete and other uses.

Lightning activity increased nine times in clouds seeded with silver iodide. One aim of the operation was to show that seeding by aircraft would reduce lightning and hail.

FROM EDITORS IN THE FIELD

Buried distribution transformer successfully withstood winter and summer loading conditions during year-long test. The air-cooled, 500-kva, 11,000-433-v, 3-phase unit was installed near Clyde by South of Scotland Electricity Board. A two-way ventilating pillar is the only visible part of the installation.

Electrically rotated flywheel provides traction power for a mining locomotive developed in Switzerland. The 3,300-lb flywheel represents about 9 kwhr at 3,000 rpm; it may be recharged in ½-2 min.

Just like a third hand!

The 88500 Universal Clamp stays open automatically while the lineman forms and bends the conductor. It remains open until the conductor is in position and the rounded nuts are tightened on the U-bolt. It's just like having a third hand.

Made of corrosion-resistant malleable iron, the 88500 accepts conductors between .20 and .50 inches in diameter. Holding strength is more than adequate for distribution deadends, helped by the snubbing action inherent in the clamping face.

Among other points that save installation time: the high wall along the clamping section which effectively retains the conductor during installation, all operations can be done from one side, and there are no loose parts to worry about.

If efficient deadending of distribution lines is one of your objectives, you can get important help by using the new O-B 88500 clamp.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

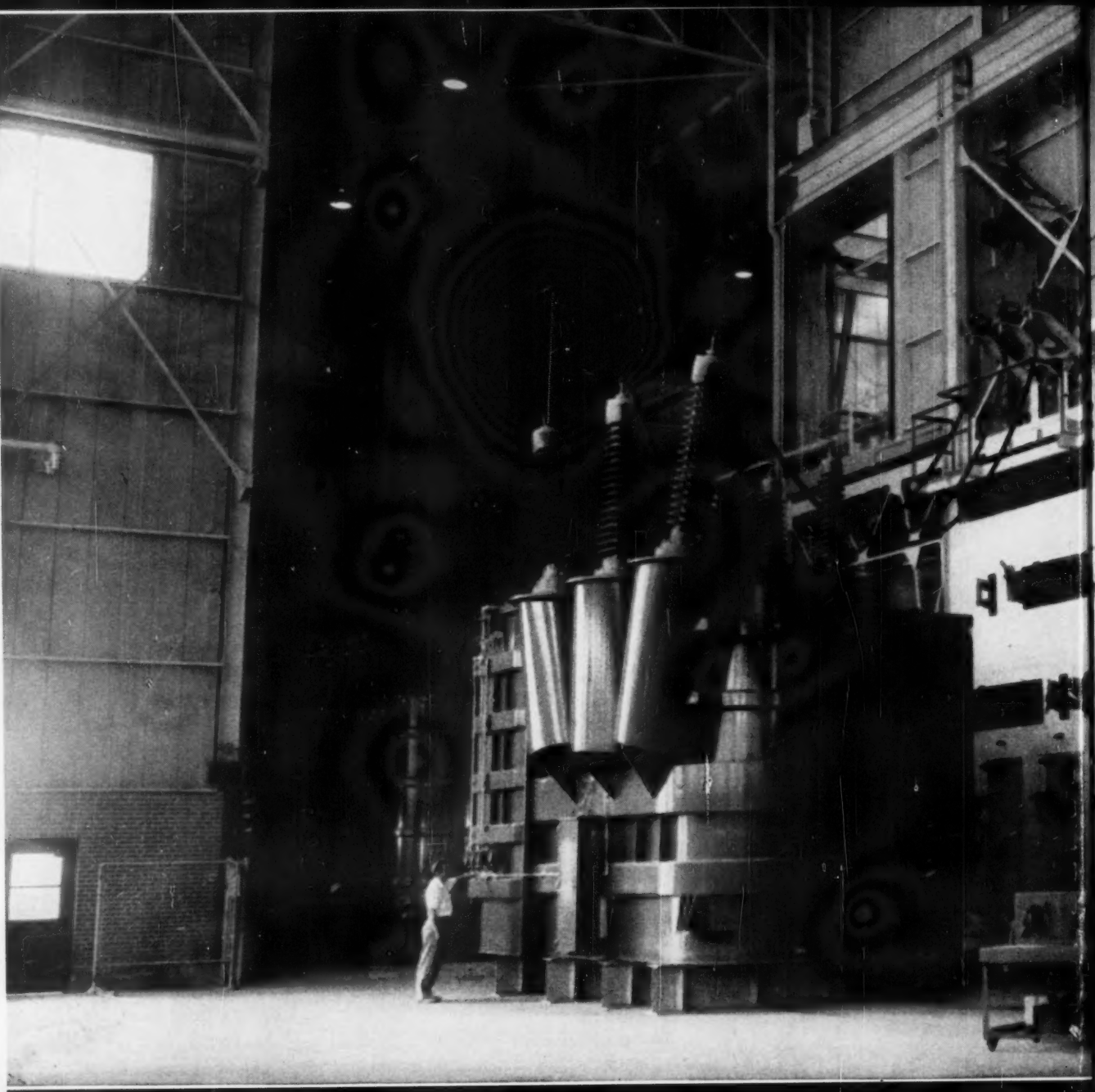
This product distributed by GraybaR ELECTRIC COMPANY

Ohio Brass

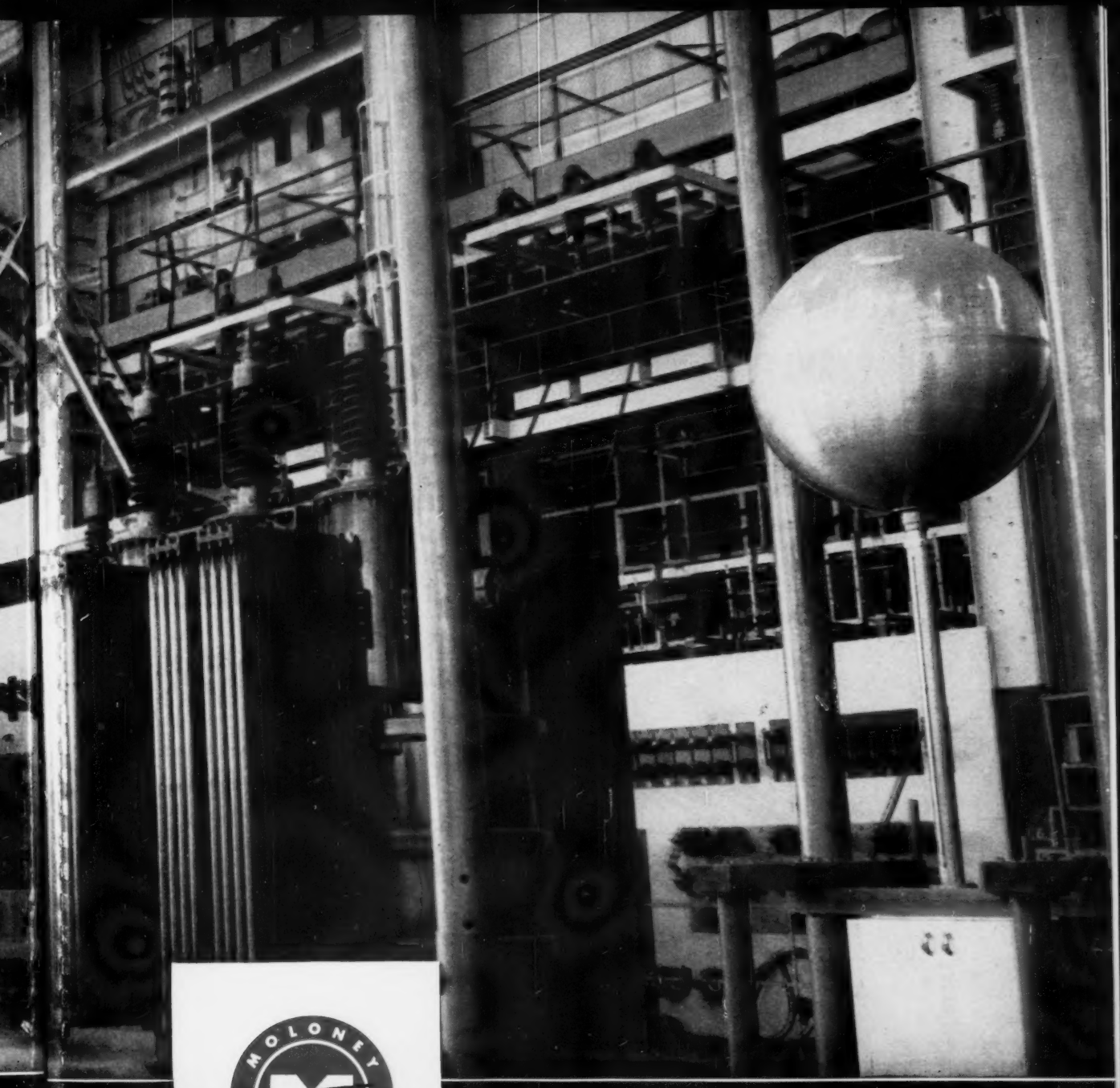
HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

65-H



PROVING GROUND



MOLONEY ELECTRIC

The "Proving Ground" for Moloney Power Transformers is this large, fully-equipped test area suitable for testing the largest of transformers.

Each Moloney Power Transformer undergoes thorough tests to prove that it meets industry standards and Moloney's high standards of quality and performance.

Thus, the test bay shown here can aptly be called the proving ground for future performance . . . the payoff of constant research and development programs.

Specify power transformers that are designed, built and proven to give efficient, dependable performance . . . Specify Moloney Transformers, All Along The Line.

ME 58 27

MOLONEY ELECTRIC COMPANY

Manufacturers and Engineers for Industry

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

When the heat's on...

ROEBLING TELLURIUM LEAD ALLOY SHEATH IS STEADY AND STABLE!

Wiping operations raise sheath temperatures up to 400° F. Stable sheath is what you need when the heat's on! And Roebling's Tellurium Lead Alloy Sheath retains its remarkable creep resistance and bending fatigue resistance under intense heat, and after it.

What's more, there's extra life built into the carefully made paper power cable *inside*. That's why there's simply no better cable buy when it comes to long life, dependable service, minimum maintenance.

Interesting test and other data are now available. Write today for your free copy of the booklet that shows the way to reduced cable and maintenance costs. Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roebling electrical wires and cables are available with either copper or aluminum conductors.

A 15-kv 400-amp station-type disconnect at a distribution disconnect price

No Sticking!...No Burning! No Pitting!...No Welding Shut!

Silver-weld contacts, a unique new development, provide 20,000 ampere momentary rating for this distribution disconnect

How is it possible to get this performance?

The answer lies in the methods of applying silver to the contact surfaces.

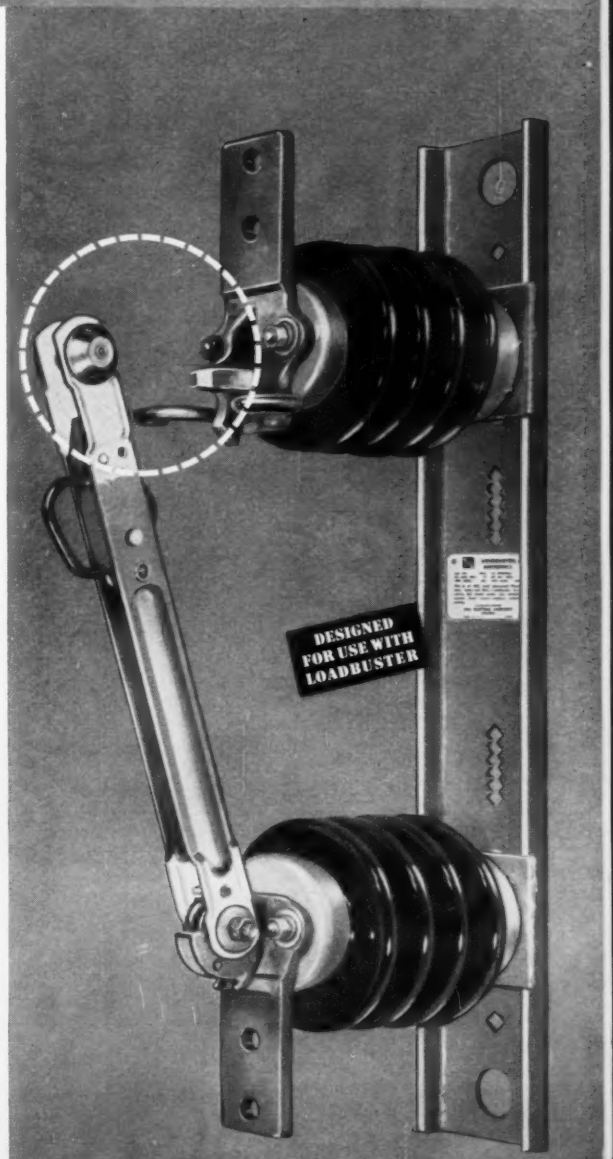
To apply silver to the contact castings, a new, patented process is used which includes special preparation of the contact surfaces, preheating them in a neutral atmosphere, fusing onto them molten particles of silver alloy, and then coining for hardness control, contour, and low porosity.

To apply silver to the blade, another method is used. The blade is silver-clad with extra-thick, high-density, low-porosity silver.

The result is a silver-to-silver contact which does not seize or gall and which makes possible the high current ratings.

But performance of a new disconnect is one matter, and performance after normal usage and exposure to atmospheric contamination is another. In practice, a distribution disconnect may be left in the open or in the closed positions for very long periods, with contacts exposed to corrosive atmospheres, typically without maintenance. Recognizing this fact, S&C has designed a disconnect that will carry its rated load, even after hanging open for long periods. On the other hand, this new S&C disconnect will open without difficulty, even after long exposure in the closed position.

And without extra cost, you get full load switching with LOADBUSTER® when you fit your distribution system with S&C LOADBUSTER Disconnects. Write today for Descriptive Bulletin 721, to S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Illinois. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

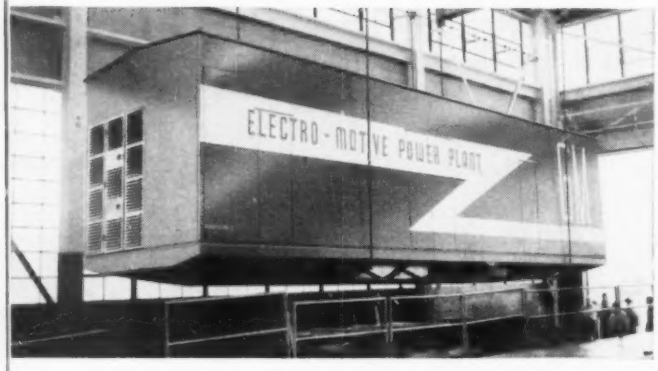


LOADBUSTER® DISCONNECTS

Disconnects • Cutouts • LOADBUSTER® • Load Interrupters • Metalclad Switchgear • Fuse Links • Power Fuses

Specialists in High-Voltage Circuit Interruption Since 1910

PEAKING POWER FOR



ELECTRO-MOTIVE 6000 KW PEAKING PLANT .... $85 per KW

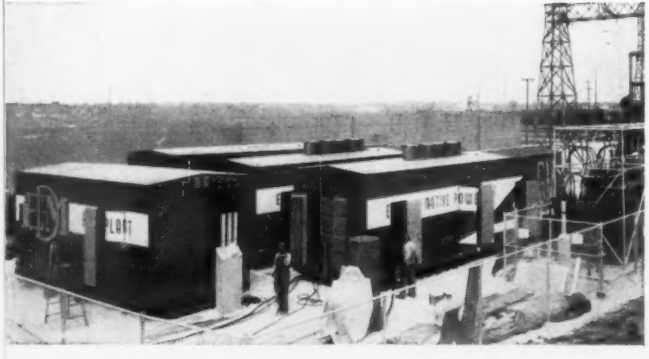
Includes: three generators, one control unit F.O.B. Electro-Motive factory, La Grange, Illinois.

The following installation costs were based on the plant pictured here. If your requirements approximate this typical installation, you can put 6,000 Kilowatts of peaking power into operation on your system for $100 per KW or less.

Land was estimated at a dollar per square foot, shipping costs for 1000 miles. Even supervisory control (however you wish to operate the plant—push button, time mechanism, current sensing equipment, etc.) is included. A transformer is also charged, but if you do not need one, deduct it from your estimate.

LAND, PREPARATION, SHIPPING .... up to $3.50 per KW

Includes: shipping (1000 miles from factory), 4000 sq. ft. land, grading, fill, leveling, tie foundations, positioning units, fence.

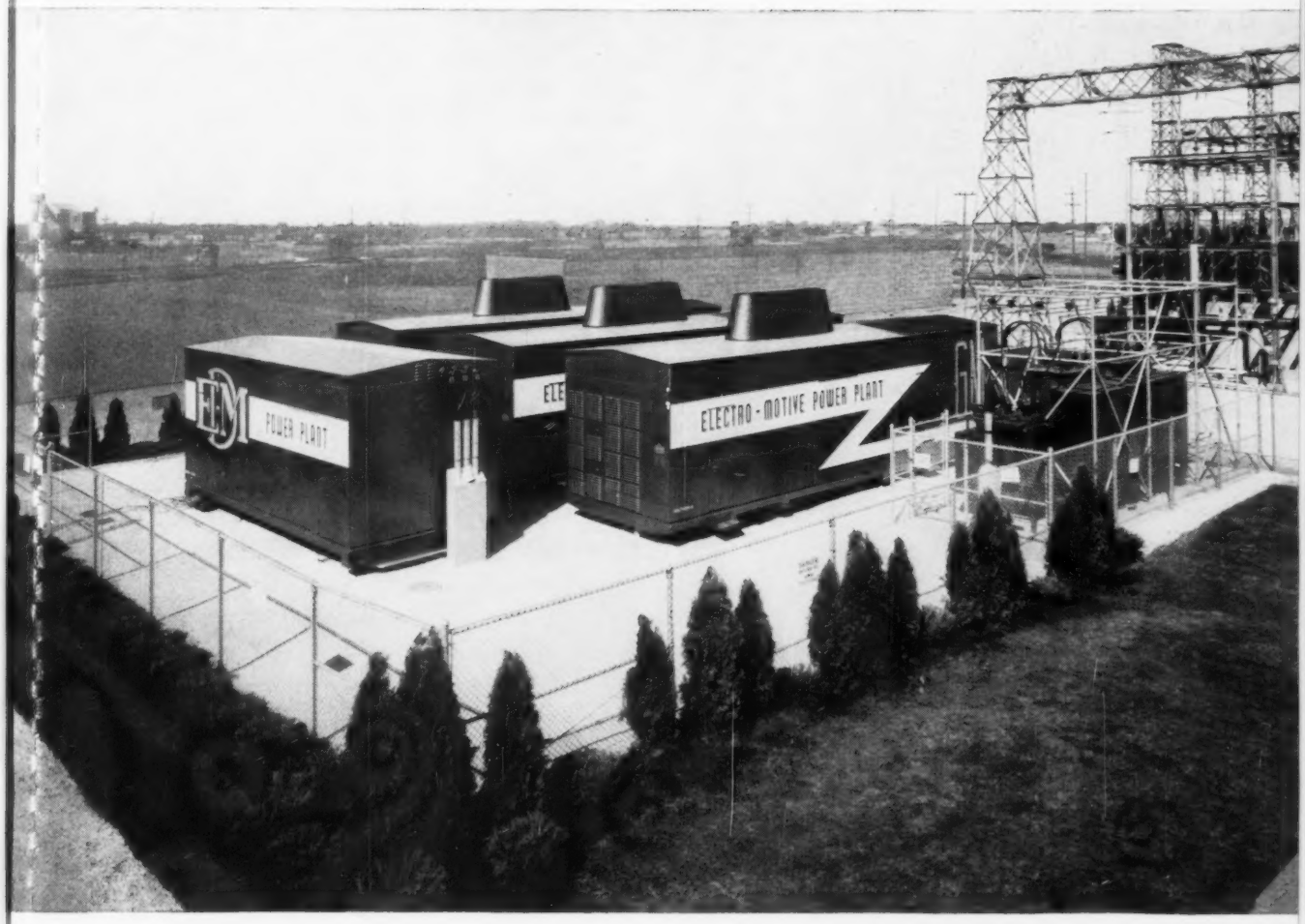


CONNECTING: FUEL, ELECTRICAL .... up to $11.50 per KW

Includes: purchase and installation above ground fuel tank, piping, cable, transformer and supervisory control.

Total installed, Operating plant .... up to $100 per KW

$100 PER KW-INSTALLED



This is the complete 6,000 KW plant as it might appear on your system. It operates completely unattended. It starts fast (cold start to full rating in less than 90 seconds) to satisfy peaking or spinning reserve requirements. It is quiet, attractive—makes a good neighbor. It is readily transportable to meet changing needs. And most important, it is made and backed by *one company*. You have only one manufacturing and service responsibility for the complete plant. See your Electro-Motive representative for complete details.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS • La Grange, Illinois

Sales-engineering offices:
Chicago, New York, St. Louis, San Francisco

In Canada:
General Motors Diesel Limited, London, Ontario

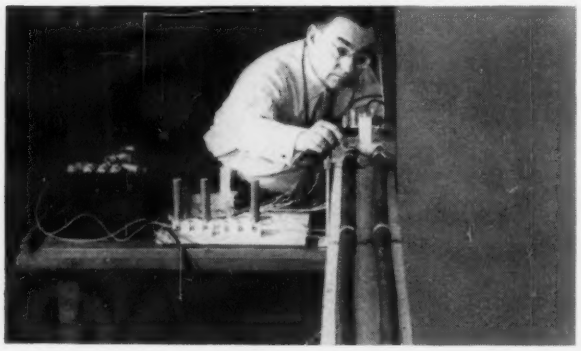
THEY PROBE THE FUTURE OF DEEP-SEA TELEPHONY

"Dry Land Ocean," under construction at Bell Laboratories, simulates ocean floor conditions, is used to test changes in cable loss. Sample cables are housed in pipes which contain salt water under deep-sea pressure. The completed trough is roofed in and is filled with water which maintains the pipes at 37° F., the temperature of the ocean floor.

Deep in the ocean, a submarine telephone cable system is extremely hard to get at for adjustment or repair. This makes it vitally important to find out what can happen to such a system *before* it is installed.

Bell Laboratories engineers do this by means of tests which simulate ocean floor conditions on dry land. Among many factors they test for are the effects of immense pressures on amplifier housings and their water-resistant seals. They also test for agents which work very slowly, yet can cause serious destruction over the years—chemical action, marine borers and several species of bacteria which strangely thrive under great pressures.

Through this and other work, Bell Telephone Laboratories engineers are learning how to create better deep-sea telephone systems to connect America to the rest of the world.



Highly precise instruments developed by Bell Laboratories engineers are used to detect infinitesimal changes in cable loss—to an accuracy of ten millionths of a decibel.

Seawater and sediment in bottle characterize ocean floor. Test sample of insulation on coiled wire is checked for bacterial attack by conductance and capacitance tests.

BELL TELEPHONE LABORATORIES
WORLD CENTER OF COMMUNICATIONS
RESEARCH AND DEVELOPMENT

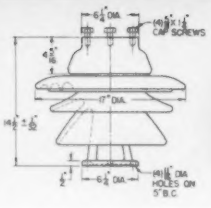
the *new look* in SWITCH AND BUS insulators

LOCKE CAT. NO. 23333

NEWEST General Electric HIGH STRENGTH insulator • gray or brown • light weight • time-proven design • economical stacking arrangements ▶▶

Progress Is Our Most Important Product

GENERAL ELECTRIC



CONSIDER THESE ADVANTAGES

The new Locke* No. 23333 insulator is a truly outstanding achievement of modern ceramic and product research. Consider these benefits . . . Gray or Brown Color . . . High Strength . . . Light Weight . . . Small Diameter . . . Same Leakage . . . Time-Proven Shell Design . . . Economical Stacking Arrangements. This engineering feat has been accomplished with *no increase in selling price* over our nearest equivalent high strength insulator.

Combination insulator stacks are not new. What is new is a standard strength (No. 7785) and a *high strength* (No. 23333) unit of identical capacitive characteristics. This insures identical voltage distribution on equivalent standard stacks, high strength stacks, or combination stacks. Minimum cost . . . Maximum electrical rating on any combination stack.

Complete electrical interchangeability between the new high strength 23333 and the standard 7785 insulators makes possible many combination stacks with cost savings as high as 30.4%—when compared with stacks of high strength units of equivalent electrical characteristics.

Tabulated below are the electrical and mechanical characteristics of the new 23333 in many stacking combinations. Note the identical electrical characteristics. Only one insulator is required on two and three high stacks to develop the equivalent cantilever characteristics of a stack of high strength insulators, with *no sacrifice in electrical ratings.* For the four, five, and six high stacks, only two new high strength insulators are required. Similarly, on seven and eight high stacks only three new No. 23333 units are needed.

Economical Stacking Arrangements

No. of Units in Stack	LOCKE CAT. NUMBER	STACK CHARACTERISTICS—Values for entire stack																	†† PERCENT WEIGHT SAVINGS	† PERCENT DOLLAR SAVINGS
		Suggested KV Rating	Height Inches	Flashover—KV				Withstand—KV			Radio Influ. Voltage		Mechanical Strength					Leakage Dist. In.	Dry Arc. Dist. In.	
				Low Freq.		Impulse		Low Freq.		Impulse	Test KV to Grd.	Max. MV at 1000 Kc	Cantilever Lbs.		Torsion in M In—Lbs.	Tension in M Lbs.	Comp. in M Lbs.			
				Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.				Upright	Underhung						
1	1-23333	—	14½	160	95	235	290	115	75	210	22	100	10000	6000	90	25	75	33	14¾	23	—
2	2-23333 1-23333 1- 7785	69	29	280	190	410	540	205	160	350	44	200	4500	3500	90	25	75	66	29	23	—
													4500	3500	40	20	60			26	17.7
3	3-23333 1-23333 2- 7785	115	43½	385	285	610	780	280	230	550	73	200	2900	2400	90	25	75	99	44	23	—
													2900	2350	40	20	60			27	23.7
4	4-23333 2-23333 2- 7785 1-23333 3- 7785	138/161	58	485	380	810	1020	385	315	750	103	500	2000	1750	90	25	75	132	58	23	—
													2000	1750	40	20	60			26	17.7
													1700	1470	40	20	60			28	26.6
5	5-23333 2-23333 3- 7785 1-23333 4- 7785	196	72½	575	475	1010	1240	465	385	900	125	500	1450	1350	90	25	75	165	73	23	—
													1450	1350	40	20	60			27	21.3
													1200	1070	40	20	60			28	28.4
6	6-23333 2-23333 4- 7785 1-23333 5- 7785	230	87	660	570	1210	1450	545	455	1050	146	500	1170	1100	90	25	75	198	87	23	—
													1170	1070	40	20	60			27	23.7
													910	840	40	20	60			28	29.6
7	7-23333 3-23333 4- 7785 2-23333 5- 7785 1-23333 6- 7785	230	101½	745	660	1410	1650	610	525	1300	180	1000	1000	950	90	25	75	231	102	23	—
													1000	950	40	20	60			27	20.3
													910	840	40	20	60			28	25.3
													750	700	40	20	60			29	30.4
8	8-23333 3-23333 5- 7785 2-23333 6- 7785	287	116	830	740	1610	1850	680	590	1470	210	1000	900	860	90	25	75	264	116	23	—
													900	840	40	20	60			27	22.2
													750	700	40	20	60			28	26.6

†Dollar savings are percent of our nearest equivalent high strength unit stacks.

††Weight savings are percent of equivalent stack of other cap and pin type units.

Additional Advantages

The combination of a new ceramic body and the time-proven shell arrangement make possible impressive weight reductions from other stacking high strength switch and bus insulators. This means easier handling, quicker assembly, and increased loadings on horizontal stack arrangements.

One completely interchangeable insulator tremendously simplifies stocking problems. A single unit usable for either standard or high strength replacement means *reduced stock investment.*

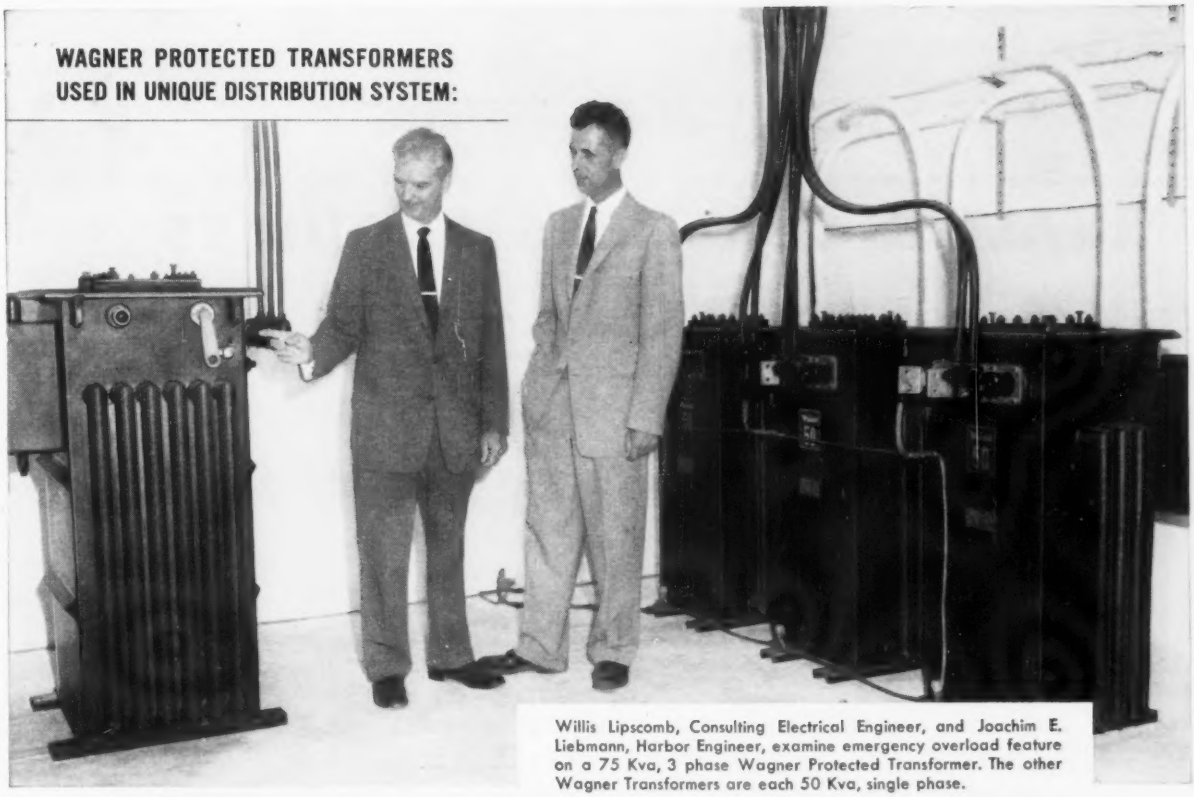
Gray makes identification easy and distinctive. Clear permanent ceramic markings of each brown No. 23333 insures positive identification.

For more information about the *"New Look"* in switch and bus insulators, contact your Insulator Department representative or write to Insulator Department, General Electric Co., P. O. Box 57, Baltimore 3, Md.

*Trademark General Electric Company

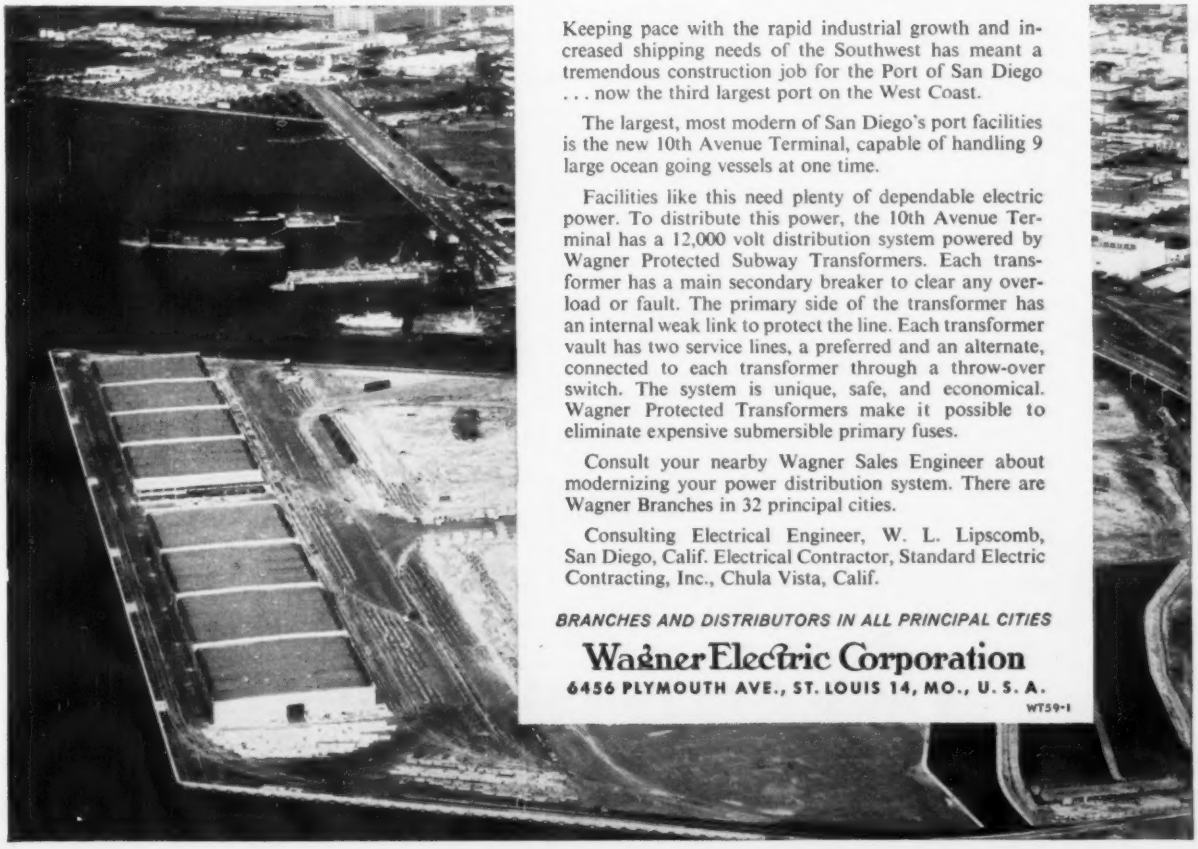
GENERAL ELECTRIC

WAGNER PROTECTED TRANSFORMERS USED IN UNIQUE DISTRIBUTION SYSTEM:



Willis Lipscomb, Consulting Electrical Engineer, and Joachim E. Liebmann, Harbor Engineer, examine emergency overload feature on a 75 Kva, 3 phase Wagner Protected Transformer. The other Wagner Transformers are each 50 Kva, single phase.

POWER for the Port of San Diego



Keeping pace with the rapid industrial growth and increased shipping needs of the Southwest has meant a tremendous construction job for the Port of San Diego . . . now the third largest port on the West Coast.

The largest, most modern of San Diego's port facilities is the new 10th Avenue Terminal, capable of handling 9 large ocean going vessels at one time.

Facilities like this need plenty of dependable electric power. To distribute this power, the 10th Avenue Terminal has a 12,000 volt distribution system powered by Wagner Protected Subway Transformers. Each transformer has a main secondary breaker to clear any overload or fault. The primary side of the transformer has an internal weak link to protect the line. Each transformer vault has two service lines, a preferred and an alternate, connected to each transformer through a throw-over switch. The system is unique, safe, and economical. Wagner Protected Transformers make it possible to eliminate expensive submersible primary fuses.

Consult your nearby Wagner Sales Engineer about modernizing your power distribution system. There are Wagner Branches in 32 principal cities.

Consulting Electrical Engineer, W. L. Lipscomb, San Diego, Calif. Electrical Contractor, Standard Electric Contracting, Inc., Chula Vista, Calif.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

WT59-1

ALLIS-CHALMERS ACQUIRES S. MORGAN SMITH ...FORMS NEW HYDRAULIC DIVISION

On February 1, the S. Morgan Smith Company became a part of Allis-Chalmers. Extensive A-C facilities in Milwaukee, together with two S. Morgan Smith plants in York, Pennsylvania, are now operating as the newly created Allis-Chalmers Hydraulic Division.

In acquiring S. Morgan Smith, A-C combines its own broad background in hydraulics with the 80 years of diversified engineering and manufacturing knowledge of SMS.

The York facilities will be devoted to the continued research, design, engineering and fabrication of a complete line of hydraulic turbines and accessories, pumps and pump-turbines, valves for industrial, waterworks and power applications, and specialized heavy equipment.

Product information or engineering help can be obtained from your nearby Allis-Chalmers office, or by writing Allis-Chalmers, Hydraulic Division, York, Pennsylvania.

HYDRAULIC DIVISION

RESEARCH | DESIGN
HYDRODYNAMICS
ENGINEERING | FABRICATION

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

DEVELOPED TO MEET YOUR NEEDS:

400/800 ampere

Dual Range

CURRENT TRANSFORMER

This new dual range transformer was developed to meet *your* needs. It combines greatly extended range with all these other features of BH-6 Transformers:

OVAL SHAPED WINDOW for greatest flexibility in application with the greatest usable opening of any 600 volt current transformer.

COMPACT DESIGN makes it easy to mount. It's the smallest, lightest transformer in its class.

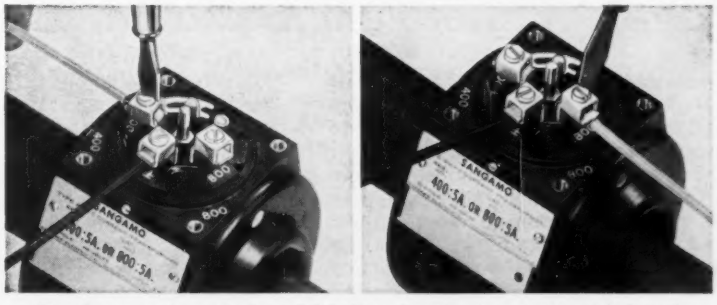
COLOR CODING . . . BH-6 Transformers are color coded in standard resistor colors for quick identification. (The new 400/800 rating is molded in black.)

CERTIFICATION OF ACCURACY . . . A certificate of accuracy test is supplied with all Sangamo current transformers. They arrive ready for you to put on the line.

you asked for it... a 400/800 ampere rating in a BH-6 Current Transformer that could provide extended capacity for future growth after initial installation on the 400 ampere range. By using one or more primary turns, this one transformer can be used on loads ranging from 40 to 1600 amperes.

Now, you can drastically lower your transformer stock levels, sharply reduce expensive changeouts, and get 0.3 accuracy class on all loads from 40 to 1600 amperes.

DUAL RANGE FEATURE:



Changing range is as simple as 1-2-3. First, close the short circuiting link. Second, transfer the secondary lead from the 400 to the 800 amp terminal. Third, open the short circuiting link.

SM59-2

SANGAMO **Electric Company**
SPRINGFIELD, ILLINOIS

Along today's modern highways easy-to-handle J-M Transite Ducts provide installation economies and years of service life, protecting traffic-signal, lighting, and other power-service circuits.

J-M Transite® Ducts install fast to last... give complete cable protection.

Because speed and economy set the pace in today's highway programs, more and more highway cables are going into Johns-Manville Transite Ducts.

For speed, Johns-Manville Transite Ducts are strong, light and long—easy to handle and install. Workmen set 10-foot lengths in place easily, join them up tight in seconds with snug-fitting J-M Plastic Couplings, and Transite's smooth bore is free of burrs and other obstructions that may interfere or cause damage during pulling of cables.

For economy, J-M asbestos-cement Transite Ducts go in to stay. Non-conductive Transite is not affected by electrolysis—resists the corrosive action of fills or high-salt soils in permanently damp locations. Millions of feet of installed Transite Ducts have proved that Transite withstands earth loads and soil stress . . . resists vibration and shock from highway traffic.

Let us send you free Transite Duct brochure EL-29A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

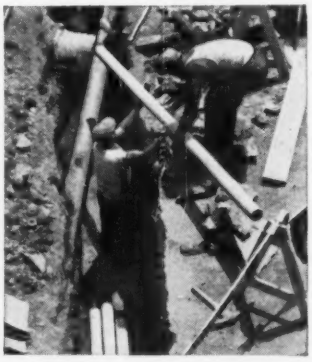
JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE Transite Ducts

Made of Asbestos-Cement

J-M Conduit for direct buried banks and exposed runs

J-M Korduct® for concrete banks



Johns-Manville Asbestos Transite Ducts can be laid directly in trench without concrete envelope or other mechanical protection.

VERSATILE

RT&E

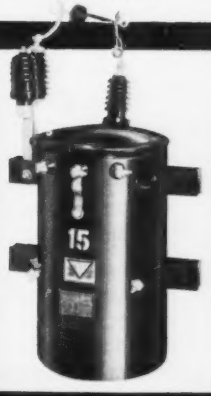
Designs distribution transformers in standard and special styles to meet all requirements

Conventional
2400 V. — 25 KVA
Typical Construction
4800 V. and below
5 — 25 KVA

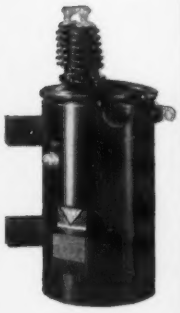
Completely Self Protected
7200 V. — 15 KVA
Typical Construction
7200 V. thru 14,400 V.
5 — 25 KVA

Duplex
7200 V. — 10/15 KVA
Typical Construction
7200 V. — 7620 V.

Protected with Arrester and Loadguard
7200 V. — 15 KVA
Typical Construction
7200 V. — 14,400 V.
3 — 25 KVA

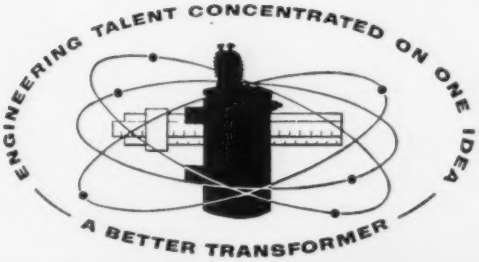


Terra-Tran
For Underground Distribution
4160 Grd. Y/2400-13800 Grd. Y/7960
and 2400 V. — 14400 V. Delta
15-100 KVA



Dual Voltage
2400 V. x 7200 V. — 10 KVA
Typical Construction
Combinations thru 14,400 V.
5 — 25 KVA

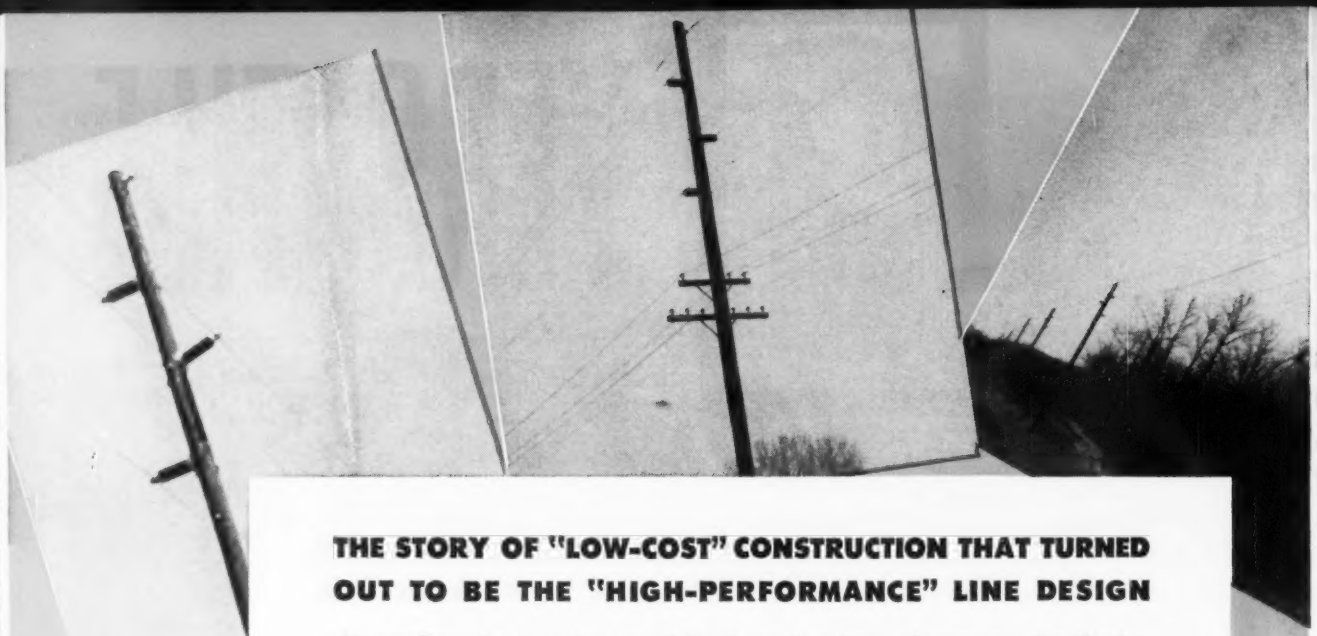
Conventional
7200 V. — 100 KVA
Typical Construction
7200 V. — 14,400 V.
75 — 100 KVA



RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

V



THE STORY OF "LOW-COST" CONSTRUCTION THAT TURNED OUT TO BE THE "HIGH-PERFORMANCE" LINE DESIGN

Almost from the introduction of the Lapp Line Post, adventurous distribution and transmission engineers started experimenting with lines on which conductors were carried on Line Posts horizontally mounted and bolted directly to wood poles.

Nobody could question the *economy* of such construction. About a 25% saving in labor. And, of course, elimination of cost for a lot of crossarms, bracing and hardware. Made an unobtrusive, trim-looking line, too. And certainly a line requiring the narrowest right-of-way you could dream up.

Well, through the years a number of such lines have gone into service, at voltages 13.2 kv to 69 kv, a few of which are shown in snap-shots here. Some of these lines now have been in service for more than 20 years. And, as we've already hinted in the headline to this piece, the service records they've built have been simply remarkable. More than one utility official has told us "the only completely trouble-free line we've ever operated."

There are sound reasons why this should be so, understandable in terms of Lapp Line Post characteristics. In the first place, it's a sturdy one-piece porcelain body, with its hardware attached externally, to impose only large-area low-intensity compression forces on the porcelain. It is the one line insulator mechanically suited to horizontal mounting.

But it's in electrical characteristics that horizontal mounting makes Line Posts shine! Wet flashover values are increased by as much as 15% over upright ratings . . . because more insulator surface is exposed, wetting is more uniform. Natural cleaning is better in wind and rain, too; dry shadow areas are eliminated, reducing incidence of pole fires and contamination flashovers.

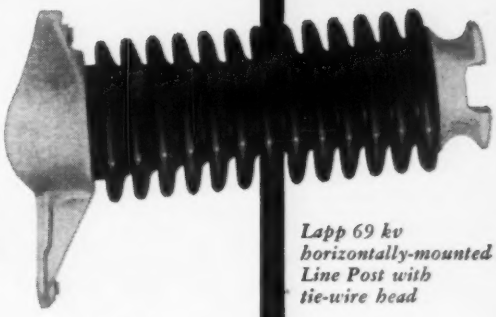
We've been encouraged . . . in fact pursued . . . to do something to get this sort of construction standardized. What we've done we're glad to tell you about . . . on the opposite page.

Entire structure is easily assembled on the ground before erection

Lapp 69 kv horizontally-mounted Line Post with trunnion conductor clamp

and now...

LAPP LINE POSTS SPECIFICALLY DESIGNED FOR HORIZONTAL MOUNTING



Lapp 69 kv horizontally-mounted Line Post with tie-wire head

A new series of Lapp Line Posts for horizontal mounting is now offered in six voltage ratings: 35 kv, 45 kv, 55 kv, 66 kv, and 88 kv. The bases are malleable iron castings with a mounting radius which will provide maximum contact to Class 1, 2 and 3 poles. Insulators are bolted directly to the pole by bolts at top and bottom of the base. This design provides that full cantilever strength of the insulator be developed with little deflection, and without failure of pole or mounting bolts. (Compare this with typical crossarm construction, where failure of braces or splitting of crossarm would occur at a value far less than the 2800 lbs. for which the insulator is rated.) In addition, longitudinal loading is possible at a value at least 50% more than can be withstood by crossarms. This extra strength permits use of longer span lengths, larger conductors and greater factors of safety.

By use of a simple outrigger shield wire and ground wires, it is practical and economical to achieve a structure flashover value with horizontally-mounted Line Posts greater than that of a typical wood-crossarm wood-brace vertical insulator assembly . . . with no possibility of wood burning or splitting. This is explained in Lapp Data Sheet No. 539, a copy of which is yours for the asking.

Lapp

LAPP INSULATOR CO., INC., LE ROY, N. Y.

NIGHT VIEW of Darien-Stamford section of the Connecticut Turnpike, with L-M fluorescent luminaires supplying the illumination.

The Connecticut state highway department has made this turnpike an outstanding example of modern highway design and lighting.

New L-M Fluorescent Luminaires Make Connecticut Turnpike Brighter, Safer

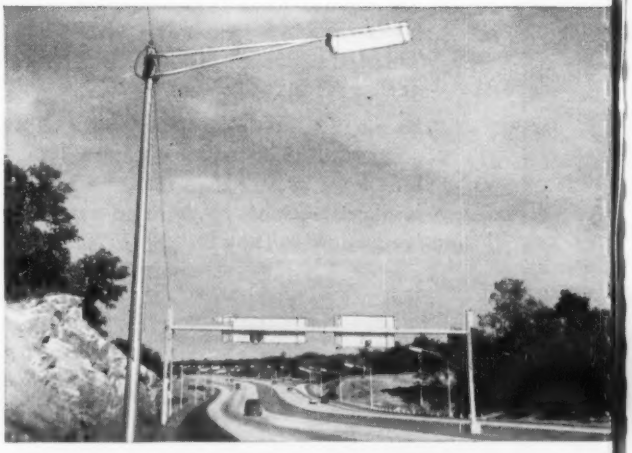
An outstanding example of modern highway design is the Connecticut Turnpike, a 130-mile ribbon across the state from New York to the Rhode Island line. Both in design and lighting, safety was a principal consideration, according to Newman E. Argraves, State Highway Commissioner.

The most heavily traveled sections of the highway are lighted for safer night driving. Line Material fluorescent luminaires were selected for the Darien-Stamford section because of their excellent appearance and the efficiency of the reflector design, which appealed to the state highway department engineers.

Line Material, a pioneer and leader in outdoor lighting, offers a full line of equipment—fluorescent, mercury vapor, incandescent lighting, and all accessories and apparatus. L-M's lighting application engineering is an outstanding service.

What's YOUR Lighting Problem?

Tell us your lighting problem. L-M Lighting Engineers will help you solve it—whether it's a highway, a neighborhood street, an airport, a shopping center, a farmyard or a railroad yard. Ask the L-M Field Engineer for bulletins and information; or write Lighting Division, Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



DAYTIME VIEW of the Connecticut Turnpike shows the deep-type 6-foot L-M fluorescent luminaire. Mounting height is 26 to 28½ feet, on 6- to 12-foot brackets, with light centers 30 feet above the highway grade.

LINE MATERIAL® Industries
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Outdoor Lighting

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

Editorial Comment

MARCH 2, 1959

A Working Audience Makes A Better Meeting

Our continuing campaign on this page for fewer and better industry meetings is matched by the hope that more imaginative programming may someday come about.

A refreshing step in this direction was taken at a recent Electronic Industries Association conference that was focused throughout on audience participation. Preprinted papers available before-hand were only briefed but not read during the sessions and the program given over to question-and-answer repartee. Some queries were submitted before the sessions; others fired from the floor. Audience reaction was favorable. Delegates reported; "We were able to explore subjects more thoroughly."

Another guarantee of audience attentiveness is inherent in Oklahoma Gas & Electric's practice of requiring—and distributing to management—a precis of papers and corridor comment from all employes authorized to attend meetings.

Nothing quickens the perception and sharpens the intellect quite like seeking out and writing down the significance and conclusions of a meeting. Certainly we know of no surer way than this to cut down surplus attendance and weed out wandering and pointless conference sessions.

The "Buy Foreign" Regulations

A few years ago President Eisenhower revised regulations under the "Buy American" Act to provide that government agencies should add 6% to foreign bid prices in comparing them with bids of American manufacturers. This is raised to 12% in areas of critical unemployment. Previously, regulations had allowed a 20 to 25% differential.

The small 6% differential had no meaning at the time, and it has even less meaning now. Public power agencies, themselves, are adding about 20% to foreign bids in evaluating the difference. But even with this concession, the American manufacturers cannot meet the foreign competition on the basis of price.

A successful American electrical manufacturer, if, indeed, he can be termed successful, earns between 4% and 8% on gross sales. If he gives up all profit, he cannot approach the bids being made by foreign manufacturers—even after the differentials have been added to foreign bids.

Foreign manufacturers have ample capacity to handle a much larger portion of the American business. They can, on the basis of price, corner a considerable share of Government buying. Government purchases abroad are already contributing materially to unemployment in several sections of the country.

Congress had charged the Office of Civil and Defense Mobilization with hammering out an equitable policy covering Government purchase of heavy electrical equipment. Such a policy must take into consideration the losses in taxes, employment, military security, and economic well-being that is occasioned by foreign purchases.

McCONE: 'Remarkable progress'

'202' A-Power Hearings

McCone's progress report blasted, capital cost aid considered for prototypes, big federal reactor program still unlikely

The Eisenhower Administration's decision to continue relying heavily on private industry for atomic power development is running into heavy fire.

Powerful Congressional Democrats are expected to propose an alternative involving government construction of reactors. But the precise nature of their program won't be clear until the Joint Committee on Atomic Energy holds hearings in March on the Atomic Energy Commission's authorization bill for fiscal year 1960.

The Administration position was spelled out a week ago as the JCAE opened its annual "202" hearings on the growth and state of development of the young atomic industry.

AEC Chairman John A. McCone said, "Efforts during the past five years have paid off in remarkable progress" in atomic power development—a claim that Rep. Chet Holifield (D-Calif.) quickly disputed.

I. AEC

Turning to the future, McCone outlined a program aimed at achieving competitive nuclear power in high-cost areas of the U. S. within ten years, and in high-cost friendly nations by 1964.

To meet these objectives, he says AEC will concentrate in the immediate future on concepts offering the greatest short-range promise—namely, the light water-cooled reactors (both boiling and pressurized), organic-cooled reactors and gas-cooled reactors.

As success nears with these concepts, emphasis would shift to other types which may offer more long-range promise. This category includes heavy water and liquid metal cooled reactors, and the breeders.

Research and development, meanwhile, would go forward at a lower priority on concepts whose economic future is more uncertain. Fluid-fueled reactors are an example.

Most Democrats probably are willing to accept this statement of priorities which, in fact, constitutes the narrowing of AEC efforts recently predicted. However, they clearly are not willing to accept the AEC philosophy and program which goes with it.

McCone recognized three stages in the program, and industry's role would be different in each:

- Research and development. This stage is aimed at establishing technical feasibility of a concept up through construction of small experimental reactors. AEC agrees with joint committee Democrats that this should be basically a government program.
- Prototype construction. When a given concept shows promise of superiority to other concepts already under development, a prototype may be built.

McCone is willing for the government to build prototype reactors where industry is unwilling or unable. He agrees AEC should exercise tight control over technological direction and speed of private efforts under the demonstration program.

And, in a major departure from past policies, McCone says AEC "will consider giving financial assistance toward the capital cost of prototype reactors to utilities willing to construct and operate such reactors under conditions which assure that the objectives of the commission are being met."

Specifically, AEC proposes to authorize construction grants up to 50% of the total capital cost of the prototypes. However, McCone's preference is clearly for smaller prototypes because they can be built more quickly at less cost, and with greater flexibility.

- Construction of commercial units. McCone says these should be left for industry construction on "their strict economic merits."

McCone sees the proposed AEC authorization bill as the first step in the program. This proposal, involving a total authorization of $85-million for reactor development compared to the $100-million authorization last year, includes:

- $30-million for construction of not more than four experimental and prototype reactors, either in cooperation with industry or by direct government construction. Reactors to be started in fiscal year 1960 include an advanced boiling water prototype, an experimental organic cooled reactor, a small power plant (5,000 to 40,000 kw, probably boiling water) suitable for use by small utilities or co-ops, and a process heat reactor.
- Another $30-million for government construction of a graphite-moderated gas-cooled experimental reactor with an output of 50,000 to 80,000 thermal kw. This project, a scaled-down substitution for the Kaiser-ACF design authorized by Congress last year, admittedly will "not serve as a true power-producing prototype."
- $5-million for R&D aid in support of "unsolicited proposals from the utility industry to construct nuclear power plants."
- A special $14.5-million authorization for the advanced high-temperature gas-cooled power reactor proposed for construction under the cooperative program by the Philadelphia Electric group. McCone describes this project as a "courageous step forward," one that will put the U. S. ahead on gas-cooled reactors.

II. The Democrats

The AEC package fell with a dull thud among key Democrats. There is virtually no chance that McCone's proposal will be enacted by Congress without fundamental changes, even if feelings ruffled by Rep Chet Holifield's attack are smoothed over (see p 20).

For one thing, the Democrats charge the Republican Administration is offering a program involving a net of only $14-million in new

Off to a Heated Start

authorizations. They arrive at this figure by subtracting the $51-million gas-cooled reactor authorization which AEC now proposes to rescind, and a $20-million cut in the cooperative demonstration program.

In addition, Holifield says the Administration program is "pitifully small" when cutbacks simultaneously proposed by AEC are considered. These include cancellation of the Chugach, Alaska, cooperative project; postponement of the Consumers Public Power District project at Hallam, Neb.; modification of the Kaiser-ACF gas-cooled reactor design; and elimination of the liquid metal reactor experiment. The Democrats are not mollified by the capital subsidies proposal because it does not go far enough, and because they believe it contains some hidden curve balls thrown at the public power-rural co-op bloc.

Democrats like Sen Clinton Anderson of New Mexico, chairman of the committee, believe prototype reactors should be built by the government at AEC sites without waiting for industry participation. Anderson is a proponent of capital subsidies, but believes they should be reserved for the larger near-commercial-sized reactors.

III. Industry

Spokesmen for the electric utility industry and atomic manufacturers testified to technological progress being made with nuclear reactors. And they had their say on the policy questions brought up at the hearings.

Philip Sporn sounded the chief note of caution. He reminded the lawmakers that, even if A-plants account for 55% of all electric generation by the year 2,000, 80% of the nation's total energy needs must still come from other sources. The American Electric Power Co president reaffirmed his support for a vigorous development program, and proposed that the emphasis be placed on research and development, whether or not this leads to construction of prototype and demonstration plants.

Equipment firms have generally gone along, too, with the thought that the government should stay largely out of the power producing reactor business. However, there's been a swing in sentiment among both groups for some kind of capital subsidy.

Charles H. Weaver, Westinghouse vice president, for example, says government help is definitely needed, particularly in areas of fuel development and construction of reactor prototypes from 10 to 100 Mw.

"Undoubtedly capital assistance would greatly accelerate the construction of prototype reactors," he says. "However, I would be cautious in granting capital support for large-scale plants." Weaver feels more prototype experience is needed even for the water reactors, where much work has been done.

W. Kenneth Davis, former chief of AEC's reactor development division and now a Bechtel Corp vice president, suggests that limitations of money and manpower restrict the number of concepts which can be realistically pursued on a large scale.

Davis endorses the idea that AEC should exercise direction of the cooperative demonstration program, but he warns, "The plants . . . must meet the requirements of utilities and be acceptable to them or they will not be utilized and thus will not be of value . . ."

Industry should be clearly eligible for assistance with prototypes, "even though industry initiated the project rather than the AEC," says Davis. "The recent change in the 'ground rules' for the power demonstration reactor program appear to make this difficult."

Davis adds this observation: "Prototype or larger nuclear power plants should be operated by and be the responsibility of operating utilities rather than laboratories or non-utility contractors if they are to provide the technical and economic data . . . desired." He endorses capital grants for prototypes and "semi-commercial nuclear power plants which may be needed to bridge the gap between prototypes and the very large reactors which may be economic earliest."

Clyde Ellis, National Rural Electric Cooperative Assn, made the strongest pitch against capital subsidies. They would "ultimately rival the subsidy now being received by the utilities under the tax amortization and liberalized depreciation program," he said.

SPORN: Emphasis on R&D

Speaking for the American Public Power Assn, Samuel B. Morris again called for an ambitious government reactor construction program, including prototypes as well as second generation plants.

IV. The Outlook

The Democratic alternative to the Administration program won't become clear until hearings are held later in March on the AEC authorization bill. Key Democrats on the committee have the votes to put over almost any program they propose. But they'll be restrained by knowledge that Eisenhower's economy minded Budget Bureau may refuse to release funds for unwanted projects. Enactment of a big federal reactor program is still unlikely.

It is known, however, that strong sentiment existed on the committee for a program involving government construction of at least one power-producing prototype in addition to the Kaiser-ACF design, and AEC-supported private construction of one or two larger plants.

Speculation is that the capital subsidy proposal will be expanded by the Democrats to include grants for construction of second and third generating plants. Some kind of provision will be made to allow full participation by co-ops and municipals. And, observers agree, the special authorization for acceptance of the Philadelphia Electric group proposal may well hinge on AEC agreement to go ahead with Kaiser-ACF reactor as originally planned.

Heating Passes Rough Winter Test

Utilities report good performance despite a few heat pump problems. Promotion efforts are intensified, rate changes reviewed

Weird weather that has plagued many a utility's operation this winter failed to dampen prospects for electric heating or the ardor with which many systems will promote it this year.

Heating installation performance ranged from "good" to "excellent" for all 27 utilities and one federal wholesaler contacted recently in a spot survey. Customer complaints on bills and equipment increased slightly in a few areas where temperatures lingered too low for too long. For the most part, though, complaints were "normal," except for a few operational difficulties on some heat pumps.

Only the Pacific Northwest, the West Coast, and sections of Arizona and the Midwest experienced normal or warmer-than-normal temperatures up to Dec. 1, the survey indicates. Still, the colder regions reported satisfaction with the standard insulation level (6 in. for ceilings; 4 in., walls; 2 in., floors). In Michigan, where Consumers Power Co has been recommending 8/4/4, the more popular 6/4/2 appears to be adequate. Salt River Power District noted that the Arizona climate makes the 6/4/2 excessive.

Promotion plans for 1959 were not affected much by the weather. Rather, they're being influenced by "brinkmanship." Half of the contacted utilities, obviously feeling they are on the brink of sizeable acceptance of electric heating, intend to intensify efforts to get more of this load on the lines. Nine utilities providing dollar amounts on promotion averaged $30,000 each in 1958. In 1959, they'll average about $48,000. The stepped-up budgets for other systems range from 18% by a Northwest company to 400% by one in the South.

A good measure of this money is linked to the Gold Medallion Home concept along with the national EEI-sponsored all-electric push. A fair share of the funds is also heading toward the removal of two heating roadblocks—the builder who skimps on insulation and the electrician or specialty man handling the installation.

How to Convert Some Electricians

As a New Jersey utility sales manager pointed out: "Installers need more education." To meet the need his company held a series of dinner meetings, showed slides, and achieved some success in converting 350 of "the world's worst salesmen and worst price cutters—the electricians."

As for heating rates, nine of the 28 utilities set new schedules or lowered the bottom step within the past year or so. Five are studying reductions of the last step or have decreases pending before regulatory bodies. Four systems, all with winter peaks, are bucking the inducement rate trend by seeking overall increases which will affect heating customers slightly. The remainder expect schedules to remain unchanged.

Among interesting promotional plans reported to EW field editors and McGraw-Hill news bureaus, are the following highlights:

State-Wide Push Under Way in Kansas

Kansas Gas & Electric Co is participating in a statewide electric heating promotion prepared by the state's Farm Electrification Council. Primary objective for the co-op and company teamwork is "to set up more and better electric heating dealers," explains Fred Kimball, KG&E vice president. "There is a need for more dealers to provide more promotion and to represent more lines of heating equipment. There is a need for better dealers," too, he adds, which requires more dealer knowhow.

KG&E's promotion expenditures in 1959 will be about the same—$25,490, including a heating specialist's salary—as in 1958. In addition to this, about 20 to 25% of the sales organization effort goes into space heating promotion. "This organization totals 67 selling men and women plus 45 agents serving rural areas who spend considerable time on selling," says Kimball. The company's 1,250 employees "have been encouraged to actively recommend electric heating."

Indianapolis Power & Light Co, noting a very low percentage of problems and complaints on resistance and heat pump installations, told of some reasons on how they were avoided. Home service advisors call on new heating customers as they move in to explain the operation of the system. The advisors also promote

New Rates Offer Added Inducement

"Concession" or "promotional" rates continue to receive more action and study by U. S. power companies. Here are some recent wrinkles:

Last May, Alabama Power revised its urban residential schedule to include a refund. The bottom step of 1.2¢ per kwhr for all over 277 kwhr remained the same, but now, "A refund will be made each May of .2¢ per kwhr for the monthly kwhr, during the preceding 12-month period, in excess of the monthly base kwhr. . ." This applies if the sum of the kwhr for the three highest summer months was not greater than 110% of the three high winter months. The "base kwhr" is the greater of 40% of the highest kwhr used any month of the preceding 12 months or 1,363 kwhr.

An experimental residential rate is scheduled for use by Columbus & Southern Ohio Electric Co by Sept. 1, 1959. It would include a minimum charge of $25 a month. First 1,250 kwhr per month would be $25; energy in excess of 1,250 kwhr—when demand is 10 kw or more—would be 2¢ per kwhr and all additional would be ½¢ per kwhr.

With Flying Colors

budget billing for each new heat customer. On those complaints and inquiries that did arrive, IP&L resolved them in almost all instances through coordination of service on equipment, where required, and by direct personal calls to determine or explain reasons for operating costs.

Detroit Edison Co's sole difficulty during the chilly weather concerned its few heat pump customers, and was credited to erratic weather which caused the units to "ice up" and resistance heat to come on automatically. This doubled the size of monthly bills. Since home owners had no control over the situation, Detroit Ed made adjustments, basing the corrected amount of the bill on how the heat pump should have operated. The utility is revamping its sales promotion. During '58 it advertised mainly through trade allies. Budget for the cooperative activity was $15,000. This year Detroit Ed has appropriated $58,000 for a "direct" campaign, with special emphasis on resistance heating.

South Carolina Electric & Gas Co will repeat a strong promotion program begun in 1958. Based on adequate insulation, the program includes a bonus for customers who install electric space heating.

Gas Impact Doesn't Deter Electric Jobs

Washington Water Power Co, now in its second straight year of active electric heat promotion, netted about the same results in new customers as in 1957, the first year. This despite the fact that in June, 1958, the company began actively promoting gas heat through a newly acquired natural gas operation.

Tennessee Valley Authority said the relatively colder weather brought no surprises for its 150 municipal and cooperative customers. These distributors serve an estimated 238,000 electrically heated homes, 5,000 of which have heat pumps. Average annual residential use for electrically heated homes is about 22,400 kwhr compared with 5,500 kwhr for those without.

Kentucky Utilities Co plans aggressive ad and personal-contact promotion for 1959. Emphasis last year was on employee education and training of nine heat specialists. Expenditures on space heating totaled $13,000 last year. This will be increased by 400% in 1959.

Atlantic City Electric Co's Iver Dixon, sales manager, described his interest in providing a 25-year guarantee on residential electric heating installations. "We can do it easily," he said. "The only replacement would be a thermostat." Heating salesmen have countered with the argument that they're already advising customers there are no service problems, Dixon said. He believes, nonetheless, that the warranty would provide a sales point the competition couldn't offer, plus dramatizing the advantages of electric heating. The company probably would offer the guarantee at first on an individual basis, if Dixon's hopes are realized. ACE would buy the thermostats and train its appliance servicemen on the replacements. Dixon conceded that a howl from contractors could raise problems on the replacement aspect.

About 17 of the utilities responding to the survey have summer peaks. Although the effect of electric heating load on their system peaks is not now appreciable, a few foresee evidence that the day isn't too far away when the load will be filling the winter valley.

Ohio Power Co, for instance, noted a pick-up of 85,000 kw during extremely cold weather. For this year, the electric heating load is expected to total 120,000 kw.

Edward A. Wilson, Alabama Power Co vice president, supplied the graph shown below and said: "While our electrical heating load is still a minor part of our over-all sales, we believe that minor adjustments in winter peaks can be seen by comparing the 1958 experience with that of 1957."

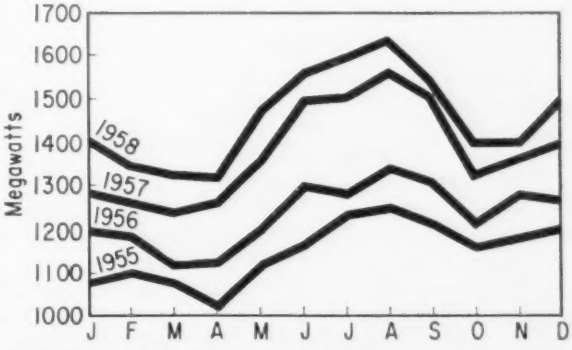
For Pacific Gas & Electric, resistance heating load added in 1955 totaled 36,400 kw. Last year some 52,000 kw was added, and about 55,000 kw is the 1959 goal. The company's big irrigation pumping load, though, still brings a sizeable differential between summer and winter peaks.

EAR Average Is $207 Per Home

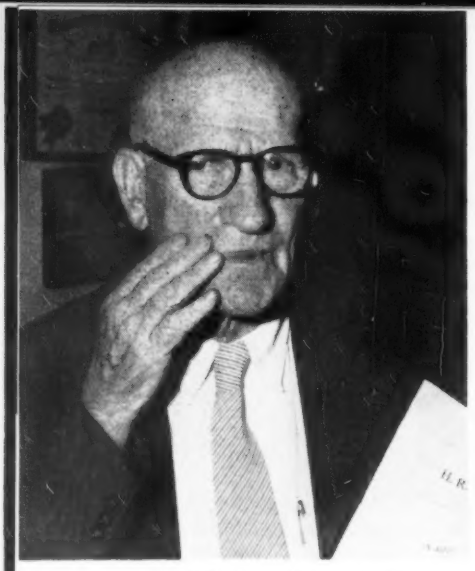
The surveyed utilities serve about 315,000 electrically heated homes, 10,000 of which have heat pumps. Some 15,000 commercial-industrial installations were reported by the participants, with 3,000 of these using heat pumps. On earned annual revenue, 17 answers produced an average of $207 per home; the range included a low of $82 to a high of $330.

ELECTRIC HEATING PROMOTION programs are being increased. Surveyed utilities are upping promotion budgets average from $30,000 in '58 to $48,000 in '59

Winter Peak Gets a Booster



MAXIMUM DEMANDS for Alabama Power Co reflects 'minor adjustments' in comparison of 1958 with 1957 winter peaks because of electric heating, says E. A. Wilson, vp



BAILEY: Time for a lesson

Bailey Calls for Another Look At Federal Power and Imports

Once a staunch public power advocate, the W. Va. Democrat unleashes attack on TVA's contract with English firm

Rep Cleveland M. Bailey (D-W. Va.)—a long-time ardent supporter of public power—startled the nation's capital recently with a 30-minute attack in the House of Representatives against both federal power and imported power generating equipment.

"I have never been a champion of the (private) power companies," he said. "In fact, I have generally supported government power; but I think it is time for me, along with a number of others from the industrial areas, to start taking another look at this power question." He added, "I want it clearly understood that my remarks today (Feb. 17) do not apply to the rural electric associations."

Bailey's bone of contention was the rising level of imported heavy power generating equipment, and specifically, the recent award by the Tennessee Valley Authority of a 500,000-kw steam generator to an English firm, C. A. Parsons & Co.

Putting Industry Out of Business

"I have had it forcefully brought home to me," he said, "that we have been paying our taxes to subsidize cheap government power for other areas so that they could compete for our industries, but now I find they are going even further. They are spending our tax money to buy foreign equipment to put our industries and our working people out of business." Bailey represents a coal-mining and industrial area.

He continued, "We, as a nation, have become very gullible on the government power question . . . This talk about need for cheap power is a farce, anyhow. Power is the cheapest thing we buy today . . . Why is it that these government power projects are buying all of this foreign power equipment? Is it because the government power advocates want to make power a little cheaper so they can propagandize for more government power? Government power is already subsidized. It would seem to me that these tax and interest subsidies ought to satisfy them . . ."

"Where do these government power people think the money comes from to build these projects?" Bailey asked. "If they are going to dry up the tax sources that finance them, where do they think they are going to get their future financing?"

Lashing out specifically at TVA, Bailey said, "TVA wants to do some of its financing with revenue bonds. It wants to get them (bonds) from under control of the Congress. Its supporters say it needs more flexibility . . . It looks to me as if it has too much flexibility now. It has already gotten too big for its britches when it can thumb its nose at the welfare of the American working people and American industries. Instead of more flexibility, we ought to tighten it up. We should keep it right where it is and shrink it some, if that is possible," Bailey told the House.

He summed up his attack as follows: "They (public power advocates) give very little thought to taxes. Taxes are a subject they do not deal in since they do not pay any. I think it is about time we give them a little lesson in taxes—let them start paying them—they will find out the Treasury Department does not grow all this money they so freely ask for on trees."

Decision Due on New York City Plants

With storm signals up along New York City's entire tax front, the city's board of estimate last week pondered a question that will be harked back to for years, regardless of how it is answered.

The question concerns whether the aged city-owned power plants now supplying energy for most of the subway system should be sold to Consolidated Edison Co of New York, Inc, or revamped by the city.

Pros and cons were aired in a crowded City Hall meeting two weeks ago. Aligned against the sale were the Transport Workers Union, the Liberal party, and other labor and civic groups. Proponents included Con Edison, real estate and business groups, and City Administrator Charles F. Preusse.

The utility's offer, which Senior Vice President E. L. Griffith said is its final one, would include $99,382,871 for three plants plus the assumption of $22,880,000 in modernization contracts instituted since last October. Total gross purchase price offered is $125,840,000.

The company's proposal provides a 20-year contract, with fixed rates for a ten-year period, Griffith said. Adequate protection is assured for Transit Authority workers' classifications, pay, and pensions, he said. The city would benefit from increased taxes and by being relieved of the transfering employees' pension obligations, he added.

A. J. Goldberg, counsel for the TWU, called the Con Ed proposal an "unthought-out proposition." He argued that Con Ed's purchase price offer would be reduced to about $89 million because of interest lost in Con Ed's three years of payments.

AIEE

75th Year
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WINTER GENERAL MEETING

Marking its diamond jubilee, the American Institute of Electrical Engineers held its biggest Winter General Meeting in New York the week of Feb. 1. More engineers, 6,545, registered than for any earlier meeting, and they had more to occupy them—some 600 technical papers, 140 sessions, 150 odd committee gatherings. Interest was high in transmission vibration and structural problems, substation gas-insulated transformers, organic moderators for reactors. Despite some debate staples—higher distribution voltages and unit vs conventional subs—the meeting evidenced engineering vitality.

Generation: Two Organic Moderators Cited

AIEE paper on nuclear power generation advances offers diphenyl and terphenyl isomers as preferable to water

Diphenyl and terphenyl isomers are better moderators than water for a nuclear reactor, said E. F. Weisner, Atomics International, in a paper co-authored by W. E. Parkins. The high boiling points of these isomers permit operation at moderate pressures in low carbon steel and aluminum systems, and their negligible induced radio-activity eases shielding requirements for the coolant system.

Canadian Advances Noted

The OMR reactor proposed for Piqua, Ohio, will provide 162,000 lb per hr steam at 450 psia 550F for existing turbines. Its fuel will be slightly enriched metallic uranium alloy. A larger unit of the OMR type could drive a 150-Mw turbine to produce power at 10 to 11 mills per kwhr, the authors suggested.

In Canada, the natural uranium, heavy-water moderated, pressure-tube reactor is most likely to produce electricity economically, said V. V. Mason and S. M. Jones, Canadian Westinghouse. The pressure-tube design permits incremental bi-directional fueling for more burnup of fuel (7,800 Mw days per ton) than bulk reloading. Initial operation anticipates a 48-hr shutdown every four weeks to replace 4% of the fuel elements. But refueling under load is anticipated when suitable equipment has been developed.

Power production with the HPTR plant is expected to run 8.5 to 16 mills per kwhr with private financing, or 6 to 11 mills with public financing, common in Canadian utilities, they said. These costs are comparable with estimates for PWR plants, but the HPTR would gain from expected declines in prices of natural uranium and zirconium alloy.

The HPTR plant, as envisioned by Atomic Energy of Canada and Ontario Hydro, will resemble the PWR, except for the pressure-tubes replacing the heavy-walled reactor vessel, and the heavy-water cooling system. The 240 16-ft tubes would hold 42 tons of UO_2 in Zircaloy-clad rods, giving sufficient excess reactivity to enable operators to shut down the reactor without "poisoning out." Steam generators on the four coolant loops would produce 1,836,000 lb per hr of dry and saturated steam at 450 psia to drive a 145-Mw condensing turbine generator, they said.

Reports on Yankee Plant

Construction progresses on schedule at Yankee's PWR plant, reported E. T. Witt, Stone & Webster, in a paper prepared with C. F. Obermesser, Westinghouse, and R. E. Minkwitz, New England Power Service Co. After completion in 1960, this plant is expected to demonstrate (1) the feasibility of low-enrichment UO_2 pellets clad with stainless steel, (2) economical construction by designs and methods developed in the power and chemical industries, (3) safety from use of UO_2 clad in stainless steel with a high-integrity coolant system, all

in a containment vessel, they said.

Power cost, after experience and modifications to boost output to 160 Mw gross, is expected to average 12 to 14 mills by 1965-6, the authors said. They suggested that subsequent improvements in core costs, core life, or plant output could press power cost lower.

Station Battery Used

The need to avoid boiling in the core immediately after "scramming" from full power prohibits a complete shutdown of the auxiliary system. At least two coolant pumps must be re-energized within 30 cycles, they said. Fast backup relaying and automatic transfer of the 2,400-v pump motors to other sources safeguards coolant flow. Additional precautions are two pumps to inject borated water into coolant loops to poison the reactor following a loop rupture and fail safe protection which drops control rods during a "scram." Power supply for reactor power and temperature controls, emergency oil and lighting, and switchgear is taken from an oversized station battery, they said.

Auxiliaries Described

Electrical features of a nuclear power plant resemble those of a conventional, fossil-fuel plant, except for reliable supply to auxiliaries to protect the reactor, said T. D. Reimers, Consolidated Edison Co. At Indian Point, he said, auxiliaries will be served from two 13-kv buses normally connected to different bus sections of an adjacent distribution substation, a third supplied directly from the generator, and a fourth tied to the Orange & Rockland Utilities system. Each 13-kv bus will operate isolated, but can be tied manually to an adjacent bus. Automatic transfer will be provided for one set of cooling pumps, valve motors, and turbine auxiliaries essential to safe shutdown. Remote manual transfer will back up one each of the pumps required to cool spent fuel, dissipate decay heat, maintain seals, and operate the control rod hydraulic system.

Instrumentation and control also follow conventional plant practice except for special safety requirements in the nuclear portion of the plant, Reimers said. Duplication and range overlapping are provided for neutron counters and power-change detectors. These instrumentation channels actuate the automatic control system and can, on occasion, "scram" the reactor. Reliable power for them is taken from three 3-unit mg sets normally powered from separate 13-kv buses but backed up by the 125-v station battery which floats on the dc unit of each set. Loss of ac supply would require "scramming" the reactor, leaving enough charge in the battery to supply essential monitoring equipment for 24 hr, he said.

Features 5 Sources

Under construction for operation next year is the 180-Mw Dresden boiling water reactor plant. This features five power sources for auxiliaries which control its 65-ton UO_2 core, said W. J. Shewski, Commonwealth Edison Co. Two are 10-Mva transformers, one connected to the generator leads and the other to the transmission system. The third is a 2.5-Mva substation now supplying construction power from the 34.5-kv distribution system. The fourth is a 500-Kw automatic diesel generator, and the fifth, the station battery. Failure of all five would drop the 80 control rods to "scram" the reactor, he said.

Operation of the Shippingport PWR plant has demonstrated the ability of its electrical auxiliaries to control a nuclear station safely and effectively, said H. G. Frus, H. A. Thompson, H. A. Van Wassen, and E. J. Woolever, Duquesne Light Co. It has shown ability to follow load swings with acceptable pressure and temperature variations. And shutdowns imposed by operation of safety devices, such as coolant flow interruptions during delayed manual transfer of station service buses, had negligible effect. Operation has been simpler than at an equivalent coal-fired plant.

Key to successful operation is the auxiliary power system, they said. Cooling water and feed pumps for damage-free shutdown can be driven from a separate sub-transmission connection and a 450-kw diesel generator, if neither of the 10-Mva station service banks is energized. Vital instrumentation is safeguarded by an emergency feed from the 120-v station battery through an automatically started mg set.

Transmission:

Vibrational and structural phenomena on high-voltage lines are features of AIEE transmission discussions

Today's transmission trend to high voltage and high capacity was clearly reflected in the new emphasis on mechanical problems of vibration and the structural aspects of tower design. Mechanical problems are coming to the fore as line designs, involving larger single and bundled conductors, encounter vibration phenomena impinging on conductor life, tower adequacy, and correct application of damping. As voltage increases, economy of tower design is having an increasing impact on the economics of transmission.

Vibration behavior of 345-kv steel tower lines with both single and bundle conductor sections was revealed in a report of tests on the Muskingum-Tidd line by E. S. Zobel, American Electric Power; A. N. Shealey and F. W. Demoney, Kaiser Aluminum and Chemical Corp; and, R. R. Ruegemer, University of Wisconsin. Among their observations were these:

1. Conductor vibration is more severe at night than during the day and increases with height of conductors above ground.

2. Towers act as vibration dampers at frequencies related to resonant frequency of tower members.

3. Strains on the strand surface of vibrating conductors are about equal on both sides of suspension clamps.

4. Maximum vibration of conductors was caused by wind velocity of the order of 2 to 4 mph.

5. Vibration of horizontally twinned Drake conductors without spacers is 1/3 that of single conductors. Spacers reduce vibration to about 1/5.

Evidence that research in vibration brings significant savings in transmission cost was shown in a paper by M. B. Elton, BPA and A. R. Hard, Washington State College, along with Shealey. Drawing on nine years experience with vibration tests on towers and conductors,

Mechanical Problems Stressed

they said vibration research findings saved $17,000 in one line alone. They also reported 15 to 25% savings in use of dampers by selective damping.

Progress toward optimum damping of conductors is being made at Hydro Electric Power Commission of Ontario. J. E. Sproule and A. T. Edwards reported that adequate vibration protection can be had with commonly used ACSR conductors from 336,400 to 795,000 cir mil with one 8½ lb dumbbell torsional damper per 1,400 ft span.

Laboratory vibration measurement and recording techniques have been brought into the field in trailer-housed facilities developed by Preformed Line Products, according to J. R. Ruhlman, J. C. Paffenberger and S. Grosshandler. This "Dyna Lab," used in a long-term program of coordinated experimentation on vibration problems, employs telemetering systems, showing promise of getting accurate physical data from energized lines.

New Tools Described

Among new research tools was automatic electronic control for maintaining pre-set conductor vibration frequency in the laboratory, described by R. A. Schomberg, Martin Co, and F. J. Trebby, Kaiser Aluminum. Also described were two instrument systems for recording natural vibration of overhead conductors. Both replace mechanical recorders. One is a photo-oscilloscopic recording system; the other a portable field instrument for recording maximum vibration amplitude, but not the wave form. Both were described by C. B. Rawlings and J. R. Harvey, Alcoa.

Importance of reassessment of tower design criteria was illustrated by changes made by British Columbia Electric Co. in its 360 and 230-kv transmission structures over the last ten years.

L. H. J. Cook, B. C. Engineering, showed how steel weight savings of 37% were made in 230-kv designs by reducing insulator requirements and through application of insulator swing, due to wind, rather than an arbitrary 45-deg swing. Longer spans, higher tensions, and reduced broken-wire loads further increased savings, Cook said.

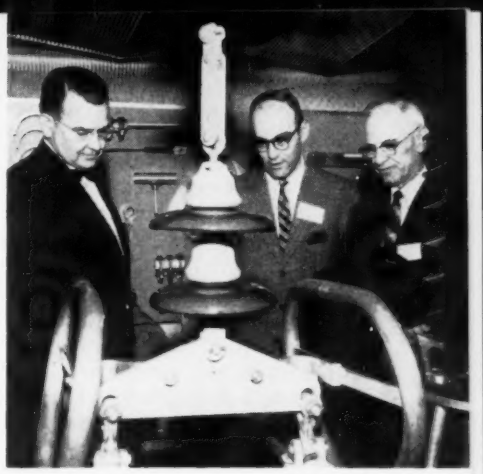
For 360 kv, Cook cited steel weight savings per mile of 50% since 1952 through reduction of insulators per string and tower clearances, as well as through reassessment of applied loads and safety factors.

Cook also described 360-kv wood-pole transmission structures used by BC Electric. They are of the cross-braced spare construction, using spiked grid gain joints.

Further emphasis was placed on the economy of structural design and the need for its continued refinements by F. W. Farr. He said BPA experience with steel tower lines over 20 years indicated that cost of steel structures in place ranges from 45 to 55% of total cost of line for 230, 287, and 345 kv. BPA has found it prudent, he said, to develop a variety of structural types for each voltage class, so that the designer can tailor a line to its location for greatest economy and efficiency.

A. V. Price, Ebasco Services, analyzed the place of steel and wood in high-voltage transmission. He observed that steel structures become more economical than wood as voltage approached 345 kv, due to the effect of height. Loads imposed on wood structures by big conductors limit usable span lengths. For example, with 795 MCM, Price pointed out, wood limits spans to 750 ft, but steel permits use of the most economical span. At higher voltages use of wood not only doubles the number of structures, but also the structure weight.

A 230-kv subtransmission system feeding directly into 12-kv distribution feeders is superior to expansion of the existing 60-kv subtransmission network feeding Vancouver, said V. W. Ruskin and A. Langmuir, British Columbia Engineering Co. The 230-kv subtransmission gives satisfactory voltage levels, service reliability, and expandability in small or large stages to meet load growth. First stage of the 230-kv network involved 14 miles of underground oil-filled cable.



CORONA SHIELDS in Alcoa exhibit at AIEE are studied by D. Kelsay, Texas P&L, D. H. Sandell, Alcoa and L. C. Enbank, Texas P&L during sessions

Transmission at 650 kv in the U.S. by 1977 was predicted by P. A. Abetti and S. B. Crary, GE, in spelling out present and future status of extra high voltage. The next ten years will see continued rapid expansion of EHV systems at 345 kv with 460-kv systems likely about 1962. Voltages higher than 460 kv do not appear justified in the U.S., they said.

Dc overhead transmission will not be used economically "to any extent" in the U.S., according to studies by A. J. Wood, S. B. Crary, and C. Concordia, GE. High dc station cost is the major determining factor in an economic comparison of ac and dc, they said. In the U.S. a minimum of about 350 miles is required to overcome the advantage of present ac systems, the authors said.

P. L. Bellaschi, consulting engineer, offered a rationalized approach to insulation requirements of transmission lines in the 115 to 500 kv range. He selected 6, 12, 15, 18, and 24 unit suspension strings for 115 kv, 230, 288, 345 and 460 kv, respectively to withstand switching surges and concluded that the same number of 10-in. units would meet 60-cps insulation requirements.

Radio influence acquires new importance in EHV lines, often becoming a major factor in selection of conductor size, said J. J. La Forest, reading a paper prepared with T. W. Liao. Both are of General Electric. Because conductors are a major item in line cost, it is desirable to base design upon accurate predictions of RI. To this end,

the authors tested several samples of carefully cleaned conductor, proving that actual RI voltage agreed closely with calculated levels. Their tests also clearly confirmed the marked reduction in RIV from bundled conductors.

In transmission radio influence depends primarily upon electrical stress close to conductors, as well as upon surface and atmospheric conditions, said J. Reichman, Ontario Hydro. Electrical stresses are controlled by design parameters, 16.65 kv rms per cm appearing from field tests to avoid excessive RI on 345 to 500-kv lines. Digital computations show that conductor size is most significant, 10% greater diameter cutting voltage gradient about 8%. Phase spacing has the second greatest effect, a 10% increase cutting gradient 1.5 to 2.5%. Bundle spacing is also important, the optimum being 8 to 10 times conductor diameter. But line height has negligible effect.

Field Tests Reported

Field tests of RI influence from a 345-kv line were staged on the Bonneville Power Administration system. As reported by G. E. Adams and T. W. Liao, General Electric; M. G. Poland BPA; and, F. J. Trebby, Kaiser, the dissipation from a 3-phase line may be considered in three modes differing in longitudinal attenuation, lateral profile, and characteristic impedance. One of these attenuates rapidly with large ground currents and strong fields at the earth's surface. The others are essentially line-to-line; their attenuation along a horizontal configuration line is 0.2 to 0.7 db per mile as compared with 6 db for the line-to-ground mode.

A companion paper by G. E. Adams offered an analytical method for predicting these field distributions. In discussion, R. H. Schlomann, American Electric Power Service Corp, cited 345-kv field tests which disclosed rain 100 miles away. The slow attenuation of such RIV may impose lower tolerances for an entire line, he suggested.

There are indications that satisfactory field and laboratory instruments may be available soon for measuring radio noise based on mean square or rms readings. Such a meter was described by F. J. Trebby, Kaiser Aluminum & Chemical Corp. Basically it is a square law plate-circuit detector in which IS5 tubes operate to produce a plate current that is a squared function of instantaneous grid voltage. Ac input is rectified to dc output and averaged by the high time constant of the output meter which reads average squared value of input per kc of band width. Thus the reading is proportional to the power in the noise signal over a given band width.

W. S. Price, American Electric Power and G. E. Adams, General Electric, speaking in discussion, said the Trebby meter is almost an ideal solution of present noise measurement problems on transmission lines, *ie*, the use of a quasi-peak detector and defects inherent in present noise meters.

Dr. C. J. Miller, Ohio Brass Co, offered laboratory assurance that when the new method of RIV measurement on HV devices is adopted, there will be no need to change RIV standard levels now in existence. Catalogues containing RIV levels will not have to be changed with changes in standard.

Miller also presented results of laboratory tests showing agreement between Stoddard and Ferris radio noise meters and concluded that they will give satisfactory RIV measurements when the proposed standard is adopted.

Use of corona shields appears justified for both single and double conductors in most HV applications, as they reduce RIV levels under dry conditions without impairing results under wet conditions. In their paper, J. Kaminski, B. E. Kingsbury, and F. C. Vose, all of GE, concluded from laboratory measurements that under wet conditions, corona shields improve RIV performance of single conductors, but do not improve performance of dual conductors.

Voltages produced across tower insulation of transmission lines struck by lightning can be determined by measurement on geometrical models. Such measurements, successfully made on models of Ohio Valley Electric Corp 345-kv transmission towers, were reported by F. A. Fisher, J. G. Anderson, and J. H. Hagenguth, all of GE. Measured response to rapidly changing lightning stroke currents showed notable agreement with calculations of Lundholm, Finn, and Price.

Substations:

Must match requirements developed for EHV transmission; suppression of corona, RI demand special attention

Substations must match requirements developed for EHV transmission. As voltages approach 460/500 kv with clearances of 8 to 16 ft, little is gained in sparkover voltage by enlarging the radius of conductors, said P. L. Bellaschi, consultant. But suppression of corona and RI requires special attention, and bundled-conductor buses may be essential.

Bellaschi urged additional study of switching surges, but suggested that pyramiding of design factors be reduced for economy in design. Reasonable clearances for a 460-kv station, he said, would be 140 in. phase-to-ground and 192 in. phase-to-phase.

Tests on substation supports and connectors show that conventional fittings for 230-kv operation are reasonably free from RI and corona up to 307 kv, reported K. A. Fleck, Anderson Electric, in a paper written with N. L. Nilsson, Anderson Electric, and P. B. Jacob Jr, Mississippi State University. They said that stress-controlling connectors are desirable for 345 kv and up, at which level control rings proved necessary on bus support hardware.

Substation designs must be reappraised periodically for the adaption of improved equipment and installation methods and to counteract increases in wages and prices, said W. R. Smith, Pennsylvania P&L Co. Experience has shown that five years is about the limit for a design standard, he said. Basic considerations in setting up a new standard are (1) compatibility with the sites to be occupied, (2) adaptability to handling by available transportation, (3) correlation with connected system to provide acceptable service continuity at reasonable cost, and (4) safe and economical operation.

Examples cited by Smith showed savings of $51,000 in a 66-kv switchyard from reappraisal of a 1947 standard to use aluminum

Substation Design Needs Revision

angle buses in lieu of copper bar, single-pole underhung disconnects for gang-operated switches, and omitting circuit grounding switches. In another case, redesigning a substation A-frame for less height over the transformer and to stand on deep concrete piers, instead of a reinforced pad, saved $10,000.

Voltage impressed on distribution feeders will be regulated by tap changers controlled by a new system in which static devices replace moving parts, according to C. J. Kettler and R. L. Elliott, General Electric. Only the time delay has moving parts, they said. The relay corrects for temperature changes and is little affected by harmonics and frequency deviations.

Distribution Subs Reach 320 Mva

Distribution substations in Consolidated Edison's system have grown in recent years to one-bank-out capabilities up to 320 Mva. According to T. D. Reimers, ten such stations are in service and eight more are scheduled for completion before 1962. Initially designed for 69-kv supply, these stations more and more will be connected to 138-kv cables, he said. They supply network feeders and radial substations in 4-kv areas. Their basic requirements are:

1. Largest possible ultimate capability.

2. Expandability to meet load growth.

3. Efficient use of costly metropolitan-area land.

4. Minimum phase angle and voltage differences on outgoing feeders.

5. Minimum system impairment by bus-section outage.

6. Facilities for fault location tests.

Use of 750 and 1,000-Mva magnetic breakers brought large savings in such stations, Reimers said. Recent installations have outdoor metal-clad switchgear and transformers in open-top cells. Breakers are not provided for the 69 or 138 kv.

He called attention to the transformer sound level "in the mid-50-db range" required by nearby apartment homes, observing that the reliability record of pipe-type cable has made consideration of a two-bank outage unnecessary.

Los Angeles built its latest downtown substation entirely below ground level, said C. M. Short and F. C. Osborn, Department of Water & Power. Its cost was 5% under that of a ground-level station surrounded by a concrete wall, and 20% under a completely enclosed station. The 85-by-126-ft concreted excavation encloses three 20-Mva FO/FOA transformers, 250-Mva 5-kv magnetic breakers for 18 outgoing circuits, and eight 34.5-kv oil circuit breakers in a separate compartment. Only the access stairways, air outlets, and an equipment hatch show outside, leaving space for landscaping, parking, or a building.

A symposium on conventional and unit-type substations in distribution systems revealed that proponents of conventional ones continue to find them flexible, easy to expand and maintain and attractive when carefully planned and landscaped. Advocates of unit designs found packaged designs compact, low in installed cost, tidy in appearance, safe and easy to apply in meeting rapid load growth. If there was one point that was more stressed than another, it was that rapid design changes made unit substations difficult to expand for load increases. This view was balanced by the popularity of unit substations in urban areas where space and appearance are weighted heavily.

T. F. Jones said Baltimore G&E uses 33/4-kv single-circuit unit subs as standard for suburban and rural distribution. He found no significant difference in cost compared to separate-component designs. The big advantage is appearance.

Ohio Edison uses both open and unit substations, but has more open ones because of their flexibility, convenience, and expandability. Contamination is more extensive in open type designs, but harder to deal with in unit subs. Rapidity of design changes in unit substations makes necessary the ordering of custom-built equipment to expand existing unit substations, E. E. Ramm said.

Indianapolis Power & Light prefers unit substations, T. F. Offenbacker said. They involve less engineering and construction, are easier to locate, and make expansion of system areas easier. When 13-kv distribution was started in 1955, it was supplied with four-feeder unit substations rated 12,000/16,000/20,000 kva and tapped from the 138-kv ring. Two such unit installations are now at each of four locations. Each pair supplies areas of 24,000 kva, and one can carry the area in an emergency.

Installed cost alone is not a satisfactory guide to choice between unit and conventional substations, said C. R. Jacobsen, Commonwealth Associates. He cited difficulties of expansion, lack of industry standardization of throat connections, and heavy damage in case of fire associated with unit designs.

To critics who found unit substations difficult to maintain, Duquesne Light Co's H. F. Klevjer suggested provision for a mobile substation. Since 1947 the Pittsburgh utility has provided 141 unit substations on its system in sizes up to 2,000 kva. Appearance and public safety weigh heavily in their favor, he said.

Substations Debated

Virginia Electric and Power Co's preference for conventional over unit substations springs from flexibility and adaptability to change. Where conventional substations can be used—and he conceded that there were places they couldn't be—A. H. Thierman felt they were easier to maintain, and engineering cost was only about 1% between the two types.

Cincinnati G&E uses 1,500 kva packaged subs for large individual loads, such as shopping centers, or where slow load growth to 350 kva per sq mile is expected. As load density grows, the next step is to 3,750 kva units with load limits of 80% on circuits, so that two regulated circuits can supply a third in emergency without exceeding 20% overload. When area load is expected to reach 750 to 2,500 kva per sq mile a second 3,750 kva, a second source, and supervisory control are added.

Distribution: Underloading Can Be

Distribution men told loading practices must recognize both thermal and voltage limits of the modern transformer

More effort is justified to establish loading practices which recognize the thermal and voltage limits of distribution transformers and their economic pattern, said A. M. Lockie, Westinghouse, in a paper co-authored by R. F. Lawrence. Underloading may be as costly as overloading, he said, considering the low impedance and load capability of modern transformers. Commonly used methods of load monitoring are not enough to determine annual load and loss factors. But the signal light on load-indicating transformers is often a fairly satisfactory indication of approach to thermal, voltage, and economic limits.

Observing that transformers are a major part of distribution investment, Lockie urged liberal design of primary and secondary lines to permit an economic voltage drop in the transformers.

Show Load on Bus

Transformer loadings are computed from customer billing cards by Dallas P&L Co, said P. G. Brittain. This is accomplished by feeding system record cards into electronic equipment to guide its tabulation of kwhr readings from the customer billing cards. Results are printed out to show kva load on each secondary bus.

This procedure costs 12¢ per customer per year after an initial survey and set-up cost of 8 to 10¢ per customer. Its accuracy has proved to be within 10% for over 80% of loads measured with recording ammeters, and within 15% for over 95%, he claimed.

The "load factor" method gives Commonwealth Edison satisfactory monitoring of load on its distribution transformers, reported C. F. Mitchell and J. A. Hughes. The system analyzes billing record cards with a computer to print out transformer loading in percentage of load capability. It also prepares two card lists of overloads, one in the order of severity and the other by reference number. Such data facilitate system reinforcements and additions to serve new loads, speed budget estimates, permit scheduled correction of overloaded transformers during normal working hours, and reduce field testing, they said.

H. K. Amchin, AEP Service Corp, observed that thermal loading cuts investment cost but boosts losses. The objective, he said, must be least annual cost. Mitchell argued that thermal and economic loading coincide at about 165% of rating. For areas having high heating loads, however, he suggested reconsideration of transformer copper losses and voltage regulation.

An older system in which meter records are converted manually to transformer loadings was described by L. J. Weed, Boston Edison Co. The method applies a graduated conversion factor reflecting the number of customers connected and their usage. It has proved capable of checking all transformers in service every two years and providing load data for engineering studies. Recourse to computer analysis is now contemplated, he said.

Digital computers will never obviate testing transformer loads, as there will always be need for measured diversity and demand factors, said L. J. Rankine, IBM Corp. He said computers offer opportunity to:

1. Reduce transformer outages by quicker detection of overloads.

2. Operate transformers closer to optimum ratings.

3. Monitor delivered voltage.

4. Control transformer expenditures.

5. Schedule changeouts during regular working hours.

A computer sized for customer billing will usually be adequate for transformer loading analyses, he said.

Transformer loading on rural systems needs further study, said H. W. Thiesfeld, Rural Electrification Administration, in a paper coauthored by T. R. McDonald and D. B. Price. Practice should be tempered by reliability requirements and local conditions. He stressed the importance of replacement costs of overloaded transformers and the no-load losses of underloaded units. Connected appliance surveys show promise of revealing accurately transformer loading for single farms, he said. T. J. Ritter, Steele Wasaca Co-op, questioned the accuracy of appliance surveys, but Thiesfeld claimed that useful data had been collected by mail.

Ferroresonance must be considered when series capacitors are applied to extend the load capability of distribution transformers, said E. F. Kratz, L. W. Manning, and Miles Maxwell, Westinghouse. It is probable whenever capacitor compensation exceeds 1.5%, they said,

Relaying:

Power-line protection study cites doubtful reliability for faults close to the carrier receiving terminal

Power-line carrier relaying provides reliable transfer-trip operation through line faults at practical carrier power levels, declared D. E. Jones, Ontario Hydro-Electric. But transfer-trip relaying using low-power, frequency-shift carrier for transmission line protection may not be reliable for faults close to the carrier receiving terminal. Power of at least 10 w would provide reliable tripping for lines up to 100 miles long.

Jones noted this high power level is required only during the tripping period. It would be quite practical to operate at present 1-w power levels normally and switch to the higher level while a trip signal was being transmitted. This mode of operation would minimize interference with other communications facilities on the same frequency.

The author's conclusions are borne out by Detroit Edison Co's experience, said J. B. Wallace. Carrier transfer-trip relays protecting transmission lines are energized

Costly Too

advising protection by a shunting resistor or gap. But laboratory and analog tests disclosed no appreciable differences attributable to transformer magnetizing impedance or core loss.

Discussion revealed that other investigators had found older transformers less prone to ferroresonance, suggesting that age may have contributed to the successful use of series capacitors by several utilities.

A 240-v-to-ground secondary system is more economical for residential consumers with peak demands of 5 kva without autotransformers or 11 kva and above with autotransformers for 120-v loads, said A. S. Anderson. He was co-author of a paper with Chase Hutchinson and S. J. Pearson. All are of Ebasco Services, Inc.

The greatest savings in residential service, he said, are realized with a two-wire, 240-v-to-ground service connected to a 240/480-v, single-phase secondary. The 240/416-v system about equals the 265/460-v-system cost for large commercial buildings where 240-v single-phase load is small. Apartments with more of this load show appreciable savings. And large savings may be realized in buildings where more capacity is needed.

Voltage-to-ground is a present standard, the level at which all major appliances and much other equipment are designed. Savings through adoption of a voltage favoring 440-v motors are significant compared with the extra cost when other lines of equipment or consumers' transformers are involved, he said.

Transformers serving 120-v load should eventually disappear when the 240-v-to-neutral systems are used for dwellings, stores, or offices. Such transformers will always be regarded as a nuisance, thus providing an incentive for use of single-phase equipment at higher voltage-to-neutral. The cost of 120-v single-phase will be much greater at the 265 than at the 240-v-to-neutral level.

Manufacturers indicate that standardization on the 240/416-v system will bring 416-v motors. This system will not preclude the use of 416 and 440-v motors.

Gives Carrier Relay Parameters

when first-line (distance) relays are tripped, he said. Commonwealth Edison reported that it is installing more transfer-trip relaying to permit high-speed reclosing at locations with weak back-feed.

Commenting on false tripping due to noise, H. G. Erdman Jr., said it is not necessarily true that noise will not cause tripping if the guard frequency is absent and the receiver tuned critically to the guard tone. Tripping due to noise may be reduced by increasing the fixed bias on the trip tube and the time constant in the trip circuit by about 1 cycle.

Broad-band Has Place

Broad-band carrier coupling has a place among power-line carrier techniques, said H. I. Dobson. This method should gain favor because of the availability of larger economical coupling capacitors and the crowding of the carrier spectrum. Broad-band techniques afford additional carrier channels on a single-phase conductor. Its one general disadvantage is the slight increase in possible interference, which, according to the author, is not too much over that obtained with resonant-tuned channels.

Dobson said that resonance between carrier line traps and the bus has been observed. He pointed out that power system switching operations can degrade the performance of the carrier channel, particularly on circuits terminating a high impedance.

Fred C. Krings, General Electric, said broad-band coupling can provide satisfactory carrier channels; overall losses are the same regardless of the type of coupler for a given set of circuit constants. I. D. Perry, Public Service Electric & Gas, said that single-tuning carrier must be used on high-voltage cable channels due to the lower low-surge impedance. He added that changes in ambient temperature alter the value of impedance of the coupling capacitor to the cable.

Loop Concept Followed

Better use could be made of impedance-matching transformer in carrier installations if engineers could determine better the impedance of the transformer itself, said S. C. Barlett, American Electric Power Service Corp. He suggested that the attenuating characteristics of the matching transformer be used to shut out unwanted frequencies.

The loop concept was followed in the design of an over-the-water microwave system for communications among off-shore oil platforms, reported R. H. Davis, Motorola Communications & Electronics. Equipment failure or a 9 to 15 db drop in repeater baseband gain automatically causes the system to feed from a central point in both directions up to the point of fault.

Considers Loop Also

E. N. Downer reported Cleveland Electric Illuminating Co has seriously considered a similar but overland loop microwave system for transfer-trip protective relaying. This technique provides standby facilities without duplicate equipment, as well as a form of frequency diversity which appears to avoid a conflict with present regulations. Factors in addition to propagation should be considered in comparing a loop system with straight-forward diversity and non-diversity-standby systems, said Downer. These include the need for two sets of sensing and switching devices at different locations; only half of the available number of channels can be used; filtering of channels cannot be used; and, noise from either direction affects a channel.

Transformers: Gas Cooled Has Promise

Custom-built power transformers, so protected, show better heat transfer and safety; and may soon be competitive

Initial experiences with gas and vapor-insulated power transformers have been uniformly successful, and more widespread use of this type of cooling is foreseen. More custom-built units are being delivered, and it is hoped that costs may be reduced to where gas-insulated transformers may be competitive with conventional units.

Design considerations and thermal characteristics of a 7,500-kva vapor-cooled transformer were discussed by Paul Narbut and Albert J. Maslin, Westinghouse. Improved heat transfer and increased safety are the outstanding features of vapor cooling, using a new class of inert fluorine-containing liquids.

To transfer heat from an open tank surface by natural oil convection at a rate of 1w per sq in. requires a temperature difference of 15C. In heat transfer by condensation of pure fluorocarbon vapor the required temperature difference vapor-to-surface is only about 3C; and by boiling of fluorocarbon liquid on the surface the required difference is only 1/3C.

The only transformers of this type now in operation employ a noncondensing gas to overcome problems of cold starting associated with vapor cooling. In the present state of development, without a noncondensing gas being present, installations are limited to those applications in which preheating a transformer prior to energization may be acceptable. The absence of oil and a minimum of organic insulating materials permit locating the transformer in the immediate vicinity of station generators, however.

Outlines Experience

G. Camilli, General Electric, outlined experiences with a 10,000-kva gas-cooled transformer. The 69-kv unit of cylindrical shape uses sulphur hexafluoride as the insulating medium at a nominal pressure of 15 psig at 25C.

Cooling is obtained by forced circulation of gas through the core and coils. A two-stage evaporative cooler cools the gas. The condenser may be installed in any convenient place, even at a distance from the transformer.

Because gas is a poor transmitter of vibration compared with oil, its use gives a transformer with better noise characteristics. The test unit, through the combined action of core and fans, generates about 8 db less noise than an equivalent fan-cooled transformer.

Total weight of the gas-insulated transformer is only about 70% of that of a comparable oil-filled, self-cooled unit. Camilli indicated that he expected costs to stabilize at 10 to 15% above those of conventional transformers within a few years.

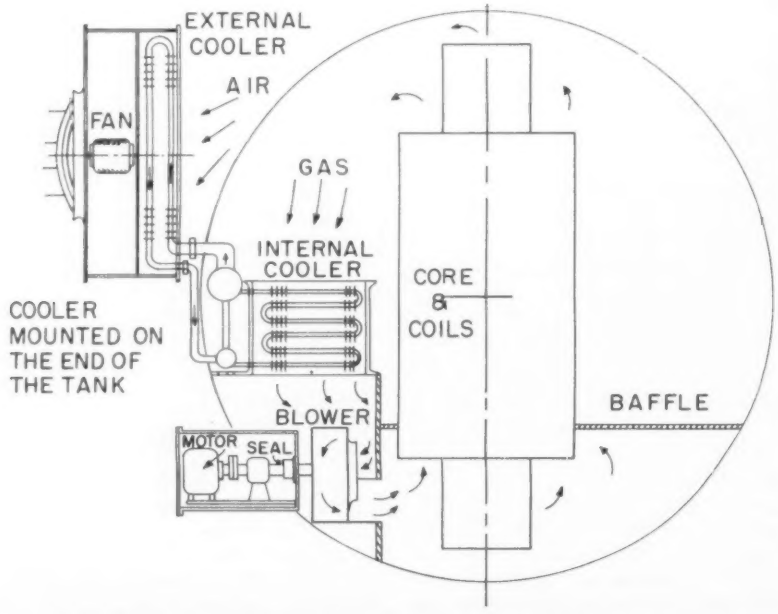
Tests on internal fault characteristics of gas-filled transformers were conducted by Camilli, L. G. Littlejohn, and W. A. Wooldridge, all GE. Tests made using electric arcs in insulating liquids (No. 10C oil and Askarel) and gases (air and SF_6) indicate that for the same energy input into the arc, the pressure developed in liquids is not less than ten times the peak pressure in gases.

Experiments revealed that gas-insulated transformers, provided with relief diaphragms, are virtually free from the danger of tank rupture under the action of heavy electric arcs. Studies are under way to determine the feasibility of eliminating relief diaphragms on gas-insulated transformers.

A gas space does not cushion internal explosions in oil-filled transformer tanks of modern rectangular design, R. J. Ringlee and N. W. Roberts, General Electric, said.

The presence of a gas space does not influence the sidewall deflection and pressure except in the case of a fault located close to the cover. There, the maximum pressure was reduced by less than half for the largest gas space tested (9½ in.) compared to the pressure for no gas space, and the effect was much less at gas spaces corresponding to normal operating temperatures.

A theoretical study showed that the stiffness of the tank to changes in volume plays a prominent role in



GAS-INSULATED TRANSFORMER has external cooler which can be mounted at remote location. Special seal for the blower motor permits expeditious repairs

determining the ultimate pressure at the tank wall for a given gas discharge energy. The calculated ultimate pressure agrees well with the tested results and indicates that the tank side pressure should vary almost linearly with tank stiffness for a stiffness range well above and below the value for the tank used.

John E. Skuderna, U. S. Bureau of Reclamation, recommended adoption of a simplified method of calculating fault currents of circuit breakers. The system, known as the X/R method, avoids many disadvantages of other methods.

Over a wide range of practical applications the X/R method gives consistently conservative results. It is readily adaptable to calculation of currents to all types of faults and can take into account special conditions where system equipment impedances are unusual.

Industrial: Put Diode Failure Rate Below 2%

Semi-conductor rectifier is simple, reliable and cheap, say industrial-application speakers, citing experience

Semi-conductor rectifiers have exceptional simplicity, reliability, continuity of production, and lower costs than other known types of power conversion equipment, according to J. L. Michaelis and E. T. Myslinsky, Columbia-Southern Chemical Corp. Describing their first year of experience with a 275-v, 100,000-amp germanium rectifier system, they reported a diode failure rate of less than 2% and a total variation in diode forward current of not more than 6% in a design using five 66-v diodes in series. Maintenance is about 8 hr a month. When the installation was planned, the designers believed that quality silicon rectifiers were not available, although a moderately sized silicon installation is on order for another plant.

Typifying the trend to silicon rectifiers for dc supplies, was a 4,000-amp, 18-v installation for plating, described by R. C. Scott, Canadian Westinghouse. Designed to take a minimum of floor space, with no external cooling requirements, it uses single-turn reactors, on Hypersil cores, to reduce current inbalance between any two rectifiers to less than 8%. Cores were assembled without an air gap. Current balancing among the 13 parallel 3-phase bridge rectifiers was obtained by feeding the output from one unit through a 1x¼-in. insulated copper bus and stacking the 12 reactor assemblies on the bus, insulating spacers between them. The copper bus acts as a primary winding for the 12 reactors.

A resonant circuit method for determining pot line and system impedances on a hot, operating line was reported by C. A. Langlois, Reynolds Metals, and V. N. Stewart and R. P. Stratford, General Electric Co. The circuit can be used to determine the inductances "seen" by a rectifier during arcbacks and short-circuit conditions, he said.

Three-phase dips in induction heating installations can be reduced by reversing the phase of the center-section coil and providing some phase overlap at the phase points, reported N. V. Ross, Magnethermic Corp. The overlap required depends on the coil and billet diameters and materials, and the frequency.

W. H. Brady Jr, du Pont, recommended that hot work on industrial electrical systems be eliminated by designing them to permit critical loads to be served from alternate feeders.

Computers: Has Increased Range, Accuracy

Large digital computer proves economical and efficient in solving transient stability problems on large AEP system

Speed, accuracy, and cost make the large digital computer an economical and efficient approach to solving transient stability problems, according to G. W. Stagg, A. F. Gabrielle, D. R. Moore, and J. H. Hohenstein, American Electric Power Service Corp. The computer permits a more accurate representation of system machines, analysis of a wider range of conditions, and increased reliability of results.

The authors described a program that handles systems of 200 buses, 300 lines and 50 induction and/or synchronous machines. The program automatically simulates fault conditions, switching, and system operations during calculation. Work is being done, they added, to include exciter response and other than constant-impedance type loads, and the program can be adapted for relay studies because system identity is maintained throughout the calculation.

Several important features mark a program for transient stability studies on an IBM 704 computer developed by M. S. Dyrkacz and D. G. Lewis, General Electric. For stability studies, system transmission and operating conditions are obtained from a steady-state load flow calculation prepared by a digital computer. Then the additional data, such as machine transient reactances and inertia constants, are added. For a system of up to 48 machines and 200 buses and 350 lines, any

sequence of symmetrical faults, line clearings, or other symmetrical switching operations may be specified.

The program does not replace the original system with a mathematical equivalent. Instead, the topological structure of the original system is retained, facilitating the calculation of specified line flows or bus voltages. Quantities of this type, which may be needed for relay settings, may be included readily with program output along with machine angles.

Tabulation of machine angles and powers are produced off-line. Switching times are specified beforehand in the program, and the program cannot be stopped at intermediate times to change switching times as might be indicated by current or voltage readings. But for monitoring purposes, an on-line printed output is also included, which can include a tabulation of angles for up to eight machines.

Reductions Possible

H. W. Hale, Wayne State University, and R. W. Goodrich, Army Signal Corps, were of the opinion that in seeking to reduce digital computational time in power-flow studies, the form of the network-defining equations has a pronounced effect on the number of iterations for convergence of a solution. When the driving-point and transfer admittance method is used as a basis, reductions of about 80% are possible. Preliminary investigation, they reported, indicates that commensurate results can be expected with larger systems. Various accelerating techniques may bring further reductions.

Along with a reduction in iterations, the time per iteration also must be considered. The driving-point and transfer admittance method helps reduce time per iteration by working with matrices usually containing many zeros.

Another paper on the problem of solution convergence in load flow studies was presented by J. E. Van Ness, University of California. One method considered by the author essentially cuts in half the iterations per solution. The 50-60 additional computer commands needed per iteration add very little computational time. When negative impedances are encountered, this method requires changes in system configuration.

Vince Converti, Arizona Public Service, presented a general method for the inversion of admittance matrices of power system networks that allows the engineer to invert individual rows of the original matrix separately without the need of solving for the whole matrix. F. J. Maginnis, General Electric, said the new report on electric utility applications of digital computers is available for purchase. If demand is satisfactory, the AIEE will continue to tabulate new applications.

At Ohio Edison Co, said D. B. Zelenka and R. H. Travers, the economy loading program, including the maintenance increment, is under constant study, extra attention being paid to conditions which incur maintenance, such as extremely high and low loads.

Consideration is given to charges for incremental coal-handling maintenance, a function of the amount of coal burned. Among these are charges for pulverizers, crushers, bulldozers, cranes, ash-handling equipment and conveyors. Analysis is made monthly of current coal costs, heating values, and generating equipment performance. Data are combined with incremental maintenance charges based on the amount of coal burned to obtain an effective fuel cost. This is set into Ohio Edison's economic dispatch computer for each generating station.

Costs Are Defined

Zelenka said the location of the break-even point in the maintenance curve can be moved from point to point in the dispatch computer, but is fixed between moves. Travers pointed out that incremental maintenance costs of two interconnected systems, even when equal, cannot be ignored in economy power exchange lest the selling company not participate in the savings indicated at the time of sale.

Three classes of costs will cover total maintenance costs of a generating station or unit in regular operation. This is the opinion of R. L. Ballentine, H. T. McCarthy, R. F. Crim, T. A. Lake, and W. S. Schmidt, all of West Penn Electric System. The first class is fixed maintenance, or the cost of keeping the plant in the ready-to-run condition; spinning maintenance covers the cost of upholding the unit or station in readiness to accept load, including start up; and output maintenance represents the costs incurred due to generation of energy. Thus output maintenance, added to incremental fuel cost, provides the desired result of incremental production cost.

Output maintenance costs used by the West Penn Electric group range from 0.1 to 1.6 mill per net kwhr; total incremental costs are 1.4 to 7 mills per kwhr. These costs are computed to the nearest 0.01 mill for use in an economic dispatch computer calibrated to receive values of this refinement. They suggested that output maintenance cost in mills/kwhr of a unit or station once established will remain practically constant even though the type of operation is changed. Only corrections for changes in the present cost level would be necessary.

Give Up-to-Date Costs

Incremental maintenance components of incremental power costs used for economic dispatch can be developed by a logical analysis of yearly maintenance cost data, said F. H. Light, Philadelphia Electric Co. A digital computer is the key to economic feasibility of this approach. The Remington-Rand Univac I computer processes in 30 min an amount of data requiring about 350 manhours. Yearly additions of data add about 2 min to computer time, but about 40 hr for manual analysis. About 25 manhours are needed to handle computer results, plus about ten clerical manhours for input data preparation.

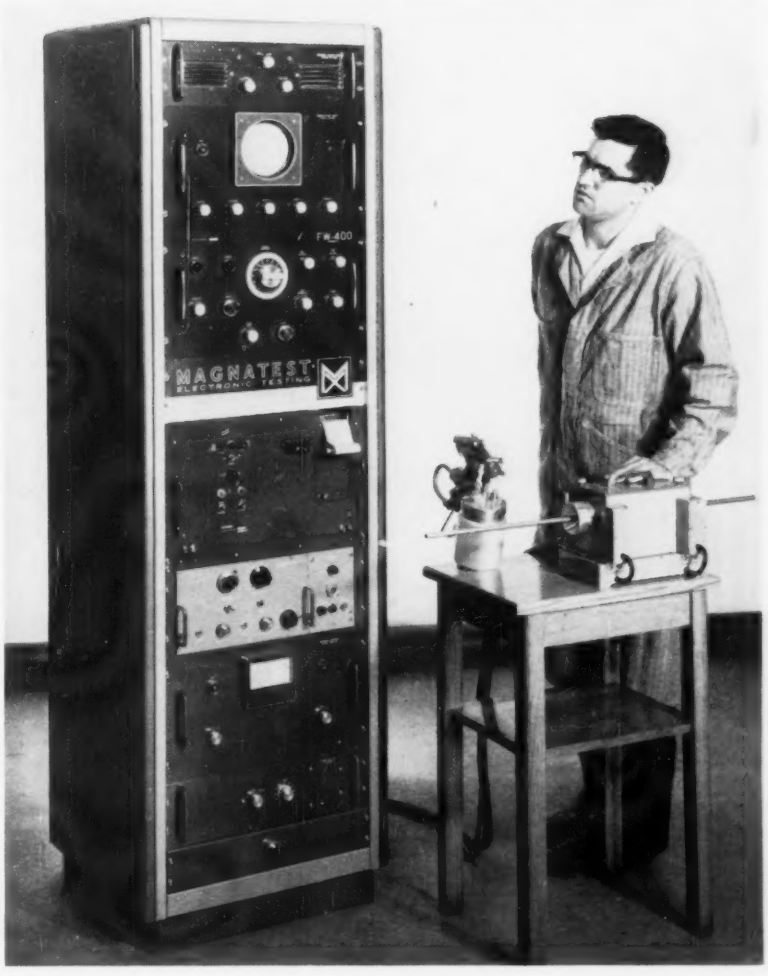
The computer approach provides up-to-date maintenance cost factors reflecting a composite picture of all maintenance cost experience in the study and provide a firm base for the projection of maintenance cost estimates. Proposed computer studies will determine the optimum number of base years to be used in this analysis.

The analytical process, he said, factors in the incremental cost of spinning reserve. Incremental maintenance costs for new units or stations are based on seven to ten years experience in older stations. Through determination of annual incremental maintenance costs, better analyses replace initial estimates.

Test Condenser Tubes Electronically

C. B. **MARETZO**, Assistant Division Engineer,

J. V. **CLEARY**, Assistant Engineer, Mechanical Engineering Department, Consolidated Edison Co, New York, N. Y.



The high purity requirement of feedwater for high pressure boilers, particularly for nuclear-powered steam generators, has stressed the critical nature of condenser tube leaks. To insure tubing free of defects beyond present ASTM requirements, electronic testing will be used in the mill inspection of condenser tubes for the Consolidated Edison Co's Indian Point Nuclear Generating Station. It will augment the usual visual and mechanical tests.

To build up a background of mill production electronic testing experience, Con Edison solicited the cooperation of tube fabricators, asking them to perform electronic tests on 27,000 aluminum brass tubes in production for Unit 3 at Astoria. Negotiations with the six tube manufacturers resulted in their agreement to procure testing machines and to investigate the practicability of production line testing.

Of the 27,000 tubes that had passed the usual manufacturer's inspection and hydrostatic tests and the Con Edison visual inspection, about 10% was rejected by the electronic equipment. A second visual inspection of these rejected tubes resulted in a net rejection of 6% of the total number previously accepted.

These fabricators used either a magnetic analysis, inspectolog or a magnatest. All three electronic machines are equipped with a control for varying sensitivity. But no two machines have equal sensitivity for a given setting, even when they are of the same make. This variation is accounted for by the tolerances to which the electronic tube components are manufactured.

Standards for setting the machines at an acceptable sensitivity were necessary to place the tube manufacturers on a comparable footing. A satisfactory setting for all machines, it was agreed, would pass a circumferential cut of 5 mils on the OD wall of the tube, but would reject the same kind of cut measuring 7 mils. As the width of the circumferential cut is as critical as the depth, a jeweller's blade with a specified cutting thickness was used to give a width of 8 mils in a 5-mil cut and 10 mils in a 7-mil cut. The machines were not found oversensitive when set to pick up the 7-mil flaw, but would still detect serious flaws not visible to the eye.

As valuable as the electronic machines have proved to be, there are definite limitations to their reliability. They pick out a number of defective condenser tubes that pass the standard testing procedures. Yet certain visible defects are not picked up when the machine is operated at a normal sensitivity. When sensitivity is increased to a point that

(*Continued on page* 60)

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Progress Is Our Most Important Product

GENERAL ELECTRIC

Test Condenser Tubes . . .

(*Continued from page* 57)

picks up these flaws, a signal is also picked up for many insignificant flaws.

Because of the direction of the plane on which the flux lines intercept the tubes, a transverse nick 5 or 6 mils deep may escape detection, but a 1-mil hair-line scratch would be picked up if it ran longitudinally along the tube. Thus a small symmetrical hole in the tube wall may possibly pass through the machine undetected.

Where a pattern of signals had been received and defects were not visible, a destructive test was made on the tube. When the tube failed under destructive testing, other tubes reflecting the same pattern and signals in the testing machine were rejected. Two instances illustrate such invisible flaws.

The first was a case of "incipient fire cracking," a series of longitudinal cracks in the tube wall not visible on the surface. This was picked up on the tester and indicated as a rapid series of alarms. In destructive tests the tubes split when both flattened and flared. The second was a case of "core," a condition in which slag has been drawn into the tube but remains invisible. Upon destructive testing the tubes split and the wall opened in a series of laminations.

A few tubes rejected by the machine had defects that could have been picked up during visual inspection. In this way, the electronic testing procedure removes much of the human error element from the visual inspection.

All reported experience has been with aluminum brass, a material more difficult to process than Admiralty or arsenical copper. One could speculate that perhaps not so high a percentage of rejection by the electronic machine would result in testing tubes of the latter materials.

Some tube manufacturers recently advertised the electronic testing of condenser tubes. The additional charge for such testing on large orders has been about 3¢ per lb. Electronic testing of condenser tubes cannot now replace visual and hydraulic testing.

But the satisfactory results obtained in testing the first lot of such tubes has encouraged Con Edison to add electronic testing to all future tubing inspections for condensers and other heat exchange equipment.

Composite Chart Speeds Line Design

EARL E. CAMPBELL, Supervising Engineer, Transmission Lines, Iowa Power & Light Co, Des Moines, Iowa

A composite design chart simplifies 161-kv transmission line design and facilitates determination of the most economical structure for Iowa Power & Light Co.

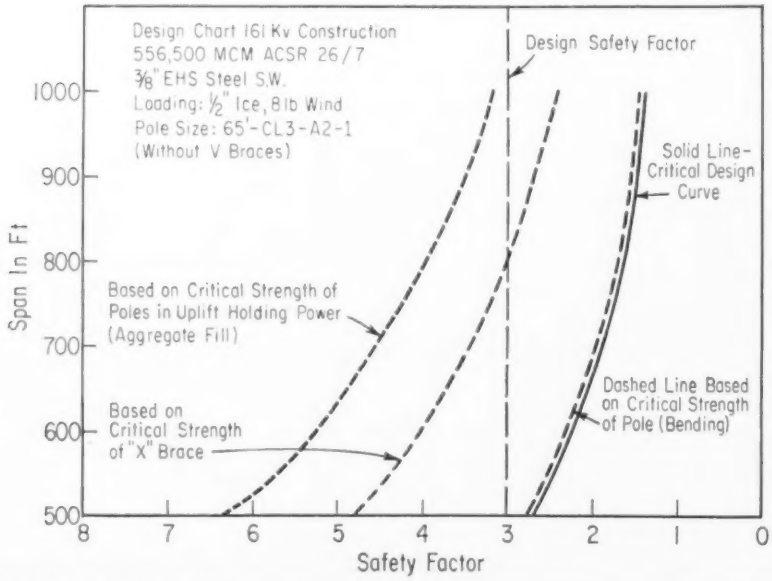
The following parameters were used in setting up the chart:

1. Phase wires: 556,500 circ mil ACSR 26 /7 conductors.
2. Shield wires: ⅜-in. EHS steel.
3. Loading calculations based on ½-in. ice and 8-lb wind.

First, the critical strengths of the poles and braces of the H-frame structure were calculated. Poles were checked for critical resisting strength to bending and critical strength in resisting uplift forces. Curves were developed from these limitations.

Critical strengths of braces were checked for various span lengths. Three separate graphs were then drawn, plotting safety factor against span length for various sizes and classes of poles. By examining these charts the controlling component of the structure can be determined for various pole sizes and classes for any span length. Composite graphs were plotted using the controlling factors from each chart.

The composite charts indicate the class of pole that will give the desired design safety factor for all span lengths. The charts also assure a coordinated design strength of all components against transverse loading.

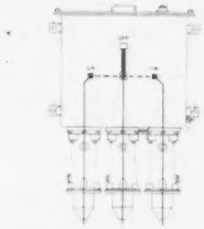


SAMPLE CHART shows development of final design curve from components

examples of G&W

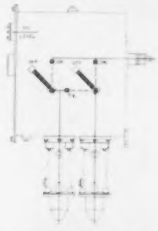
distribution system flexibility

PROBLEM:
To supply one load circuit from either of two feeders.



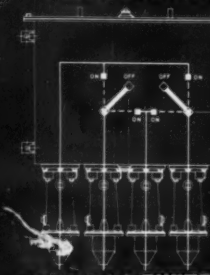
TYPE RAD-M SWITCH
THE G&W PRE-ENGINEERED SOLUTION

PROBLEM:
To connect transformer to either or both feeders looped through.



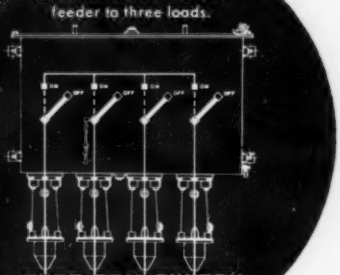
TYPE RAL-TB SWITCH
THE G&W PRE-ENGINEERED SOLUTION

PROBLEM:
To connect two loads to either of two feeders.



TYPE RAJ SWITCH
THE G&W PRE-ENGINEERED SOLUTION

PROBLEM:
To connect one load to any of three feeders—or one feeder to three loads.



TYPE RAM SWITCH
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PRE-ENGINEERED FOR MINIMUM COST

Pick a distribution system problem—and you'll find a basic G&W Load Break Oil Switch that's *pre-engineered* to solve it. G&W switches are made of standardized parts designed so they can be combined in a vast number of forms to handle specific by-passing, disconnecting, or fusing requirements. They allow you to meet the needs of individual load centers without the expense of individual engineering. Here is something new in distribution system flexibility—at lower cost that helps you keep construction and installation expenses down. Don't overlook the opportunities G&W pre-engineered load break oil switches offer for simple solutions to sectionalization problems at significant savings. Switches and combination units are available rated from 600 to 34,500 volts, 400 to 1000 amperes continuous capacity, 400 amperes load-break. Special switches to 69,000 volts can be furnished.

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Manufacturers News

Aluminum the Choice of West Penn Power for Condenser Tubes

This installation of aluminum tubes for a steam condenser typifies the inroads aluminum is making in power generation. West Penn Power Co is installing aluminum tubing in a 75,000-sq-ft condenser at Armstrong Station.

A 4-year exposure test to determine suitability of the metal for handling Allegheny River water led to the choice of aluminum. West Penn and Aluminum Co of America also coordinated efforts on a 2-year development project.

The utility specified aluminum tubes to effect substantial initial cost savings, Alcoa reports. It was found that the tubes are quick and easy to install. Using a water soluble lubricant, one crew installed 800 tubes each working shift.

Some corrosion advantage from using aluminum tubes is anticipated, particularly on the steam side, because aluminum is suited for service in the presence of ammonia and hydrogen sulfide.

About 1 million lb of aluminum tubes have been installed in power plant condensers in the five years since the first aluminum-tubed condenser was installed by Alcoa at its Sandow Power Station in Texas.

Gas Turbine Remote Controlled

A remote-control gas-turbine generating unit is being made by Westinghouse Electric Corp for installation in Venezuela. The company is also supplying several other gas-turbines to Mexico and Brazil.

The first gas-turbine electric power station with completely automatic remote controls will be put in service in Venezuela for Compania Shell de Venezuela. Two 5,000-kw turbine-generator units will power nine 1,500-hp pumping motors which will store and load oil at the rate of 700,000 barrels, initially, and over 1,000,000 barrels eventually. Turbines are designed to switch to diesel fuel in event of failure in the gas supply.

A 8,500-kw gas turbine with a new application will supply power to Mexico's largest steel mill, Altos Hornos de Mexico, near Monterrey. Exhaust gas from the turbine will pass through a boiler which will supply steam to drive a steam-turbine air blower for a blast furnace, resulting in high over-all plant efficiency.

Four 5,000-kw gas-turbine generating units were shipped to two state-owned municipalities in Brazil, as well as switchgear, start-up diesel generators and most of the equipment needed for two step-up substations. Turbines will burn residual oil with a high percentage of vanadium, calcium, and sodium salts, and will require fuel-treating systems, also supplied by the turbine manufacturer, to remove these blade-damaging impurities.

Kaiser Cuts Prices of Aluminum Rigid Conduit

Kaiser Aluminum & Chemical Sales, Inc, has reduced prices for its aluminum rigid conduit for electrical installations. The reductions vary from 10 to 14% depending on the diameter of the conduit and the shipping zone.

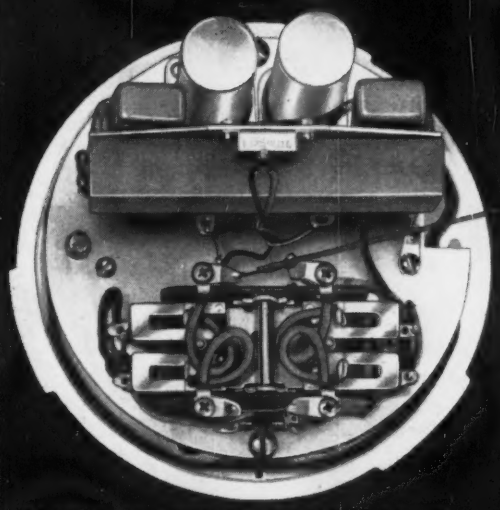
The new pricing schedule "makes aluminum conduit more economical than steel in virtually all types of electrical installations," declares J. T. Dugall, general manager of the company's electrical conductor division. He adds that aluminum conduit's light weight means considerable savings in handling.

The Kaiser conduit line ranges from ½ through 6-in. diameters, plus couplings and 90-deg elbows.

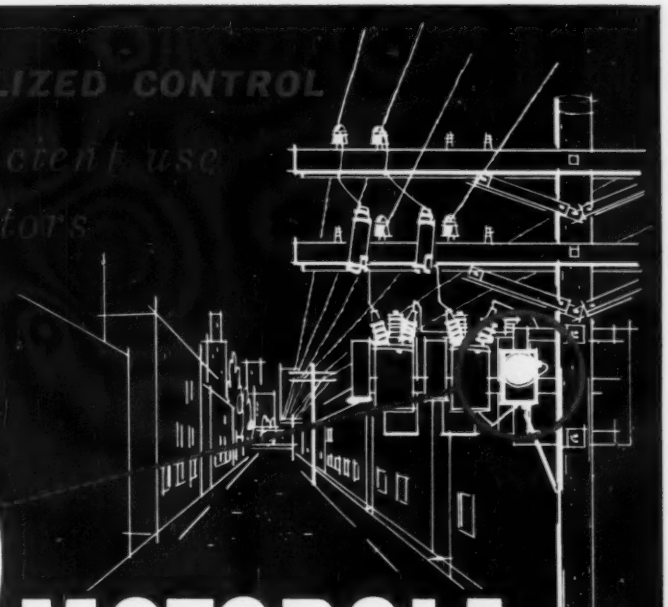
(*Continued on page* 66)

AUTOMATIC, CENTRALIZED CONTROL

gives more efficient use of capacitors



Motorola Tone Receiver is housed in plug-in watt-hour meter case—mounts on cross arm with capacitor switches.



MOTOROLA CAPACITOR SWITCHING

Motorola Capacitor Switching is...

Simple in Operation

Code tones are carrier-imposed on the feeder lines at the central substation. These tones operate transistorized, plug-in receiver-decoder units to start programmed switching. Substation program-coder unit, accessory panels, and Motorola Power Line Carrier provide the programming, sensing and switching code transmission.

Automatic

When system voltage or reactive power exceeds preselected limits in either direction, the coder automatically sends code tones to add or remove capacitor banks from the line in a predetermined sequence.

Dependable

The new switching system embodies thoroughly proven Motorola design . . . and utilizes quality Motorola equipment throughout.

New Motorola Capacitor Switching will give you more efficient use of capacitor banks. Overswing of local control capacitor switching is eliminated. You lower costs with centralized control.

Here's how: optimum system balance is obtained with an extremely sensitive Sensing Device located at a central substation where total bus quantities more clearly reflect system needs. Capacitors are switched on and off in a coordinated sequence to meet entire system requirements. System balance is maintained automatically. Motorola Capacitor Switching is simple, practical and proven in use.

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MOTOROLA CAPACITOR SWITCHING

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Another example of Allis-Chalmers

GENERAL INFORMATION

KVA	36000.
NUMBER OF PHASES	3.

CLASS OF COOLING
TYPE OF L.[illegible].C.
L.T.C. TE[illegible]V

WINDING	HIGH-VOLTAGE
LINE VOLTAGE	230000.000000
TYPE OF CONNECTION	G. WYE
RATIO OF MAX. TO NORMAL	1.05000[illegible]
RATIO OF MIN. TO NORMAL	0.9500[illegible]
LINE TEST VOLTAGE	395.00[illegible]
NEUTRAL TEST VOLTAGE	34.0[illegible]
VOLTS PER TURN	143.
NO. OF TURNS PER COIL	8[illegible]
NUMBER OF COILS	
NORMAL PHASE CURRENT	
MAXIMUM PHASE CURRENT	
CM PER AMPERE	
TOTAL CIRCULAR MILS	
SIZE OF CONDUCTOR	
INSULATION ON STRANDS	
COIL HEIGHT	
MEAN TURN LENGTH	
I SQUARE R LOSS	
EDDY CURRENT LOSS	
WATTS PER SQUARE	
GRADIENT	

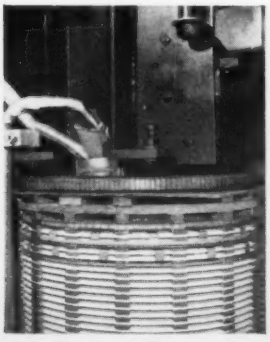
[illegible]EIGHT
[illegible]EIGHT
[illegible]IDTH
[illegible]NGTH

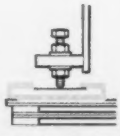
Get All the Facts

Call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

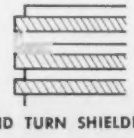
Balanced Electrically

Corona-free design puts solid insulation at the point of critical dielectric stress. Shielding protects against repeated switching surges. Line ends of windings are protected from steep wave impulse jolts. Coordinated design throughout windings provides proper margin of insulation strength for all types of overvoltages.





CLAMPING RING SHIELDING



END TURN SHIELDING

leadership in transformers

Approaching Perfection in Power Transformers Through Electronics

At Allis-Chalmers, the pursuit of perfection utilizes the mathematical wizardry of the computer. Given selected values for variables, tempered with rejection criteria, the computer produces preliminary designs in a matter of minutes. As a result, countless engineering hours are freed for furthering perfection . . . for the creative development of new ideas for transformer improvement.

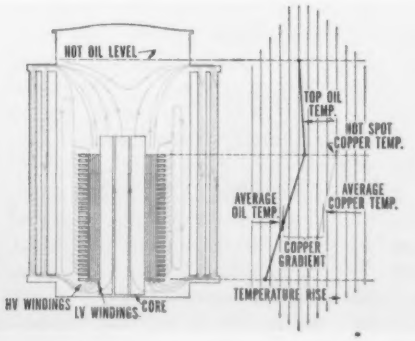
Balanced Design

The most important contribution made by the computer is "Balanced Design"—a design in which each feature complements the others to provide unmatched performance and long life.

Balanced Thermally

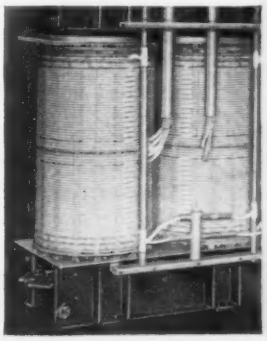
Low gradients add years of service. Coil ducts in windings allow oil to flow through and around all layers for uniform cooling. On larger units, core spacers form ducts that permit oil to flow through the core.

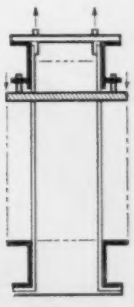
Transposition in windings keeps eddy-current losses low and distribution of current in conductors balanced.



Balanced Mechanically

High and low voltage coils are held rigidly between steel plates and supported on core end frames by jack bolts. After thorough dry-out, coil structure is compressed to specified values by jack bolts. Lead assembly is supported against short-circuit stresses while maintaining proper insulation distance.





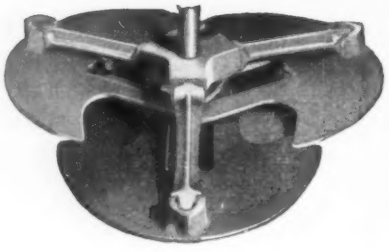
ALLIS-CHALMERS

A-5874

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

Allis-Chalmers Says Strike Hasn't Delayed Shipments

The strike of 13,500 Allis-Chalmers employees at eight U. S. plants is four weeks old today. The company reported last week that the strike situation had not yet affected the shipment of power generation, transmission and distribution equipment to the electric utility industry.

At the latest report, federal mediators had temporarily abandoned efforts to bring together representatives of Allis-Chalmers and the striking United Auto Workers.

The major issue is whether new contracts will be negotiated at the local plant level or on a central basis. The company wants to continue the present practice of individual contracts at each of the eight plants. The union is holding out for a "master-uniform" contract negotiated on a central basis.

Closed down by the strike are four A-C Works which make power generation, transmission and distribution equipment. Representing about 7,000 UAW members, the four plants are at West Allis, Wis.; Pittsburgh, Pa.; Terre Haute, Ind.; and Gadsden, Ala.

Not affected by the strike are A-C plants at Norwood, Ohio, (motors and pumps, 1,800 employees); York, Pa., (hydraulic equipment, 1,100 workers); and Boston, Mass., (circuit breakers, 550 employees).

The UAW walked out of eight Allis-Chalmers plants Feb. 2 after the company and union failed to reach agreement on a new contract. The union had been working under contract extension since Aug. 15, and negotiations had been underway since June 15. The company's offer of a general wage increase of 6¢ an hour or 2½% each year for the next three years was in line with the pattern already established in the farm machinery industry, in which A-C is a major producer.

A new three-year contract covering about 375 employees at Allis-Chalmers' circuit breaker plant in Boston was agreed on recently by the company and the IUE. Subject to membership ratification, the new contract calls for a 6¢ or 2½% wage increase each year and other employment benefits.

MANUFACTURERS BRIEFS

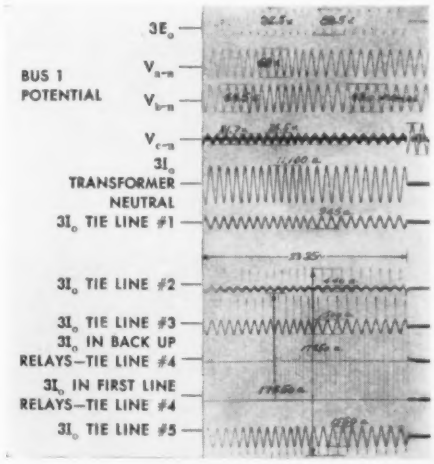
H. K. Porter Co, Inc, is continuing its expansion in the electrical equipment industry with the acquisition of National Electric Products Corp, Ambridge, Pa. The new National Electric Division of Porter will continue to make and market its lines of rigid, thin-wall and flexible steel conduit, boxes and fittings, building wires and cables, high voltage cables, and underfloor raceway systems.

Osmose Wood Preserving Co of America, Inc, Buffalo, N. Y., plans to issue markers for rejected and dangerous utility poles inspected and treated for their customers. Markers will be 1-in. square, with no printing, placed 1 ft above ground level on street side of pole. One marker designates rejected poles, two are placed side by side to denote dangerous poles.

Owens-Corning Fiberglas Corp expects to speed delivery of products and keep customers' stocks at a minimum as a result of a recently installed automatic intercity communication system. The new teletypewriter system will boost the efficiency of such operations as sales, purchases, distribution inventories, maintenance, and shipping.

Electroline Co, manufacturer of electrical connectors, cable and wire rope fittings, was purchased recently by Superior Switchboard & Devices Co. Superior, wholly owned by Union Metal Mfg Co, makes watt-hour meter mounting facilities, test equipment, and accessories.

THE HAMILTON CONSTANTLY STANDS WATCH OVER YOUR PROTECTIVE SYSTEM



HERE IS PROOF THAT IT WAS A BREAKER THAT FAILED!

This is an oscillogram of an actual fault on a solidly grounded system phase-to-ground, approximately 0.4 mile from the bus. The line circuit breaker failed to clear the fault. The oscillogram shows that both first line and back up relays had the same value of current in each, which is correct. The oscillogram shows some change in the $3E_0$ and the E_{c-n} trace as well as changes in amplitude of the $3I_0$ current at 9 cycles. This indicates that the breaker attempted to clear the fault in about normal time and failed. It also tells that this is a breaker failure not a relay or trip circuit failure. It shows that the back up relaying had the expected value of current in it and cleared the fault correctly after a time delay.

...The Hamilton RS-9 Automatic Oscillograph provides proof of sequence of relay and breaker operation—a permanent record of what happens when a fault occurs.

The Hamilton RS-9 Automatic Oscillograph constantly stands by monitoring your system. It gives you a comprehensive record of the operation of your protective system under fault conditions, providing the proof you need of the sequence of relay and breaker operation. Often, faulty equipment is shown up before it can cause damage or down-time.

Within 2 milliseconds after a fault occurs, the Hamilton is automatically at work, recording the transient wave forms for analysis. The record produced has a sharp trace that is easy to read—easy to analyze.

There are two models of the Hamilton RS-9 Automatic Oscillograph—the RS-9 Fourteen with 14 recording elements and the RS-9 Thirty with 32 recording elements. *Both were designed specifically for use in power plants.*

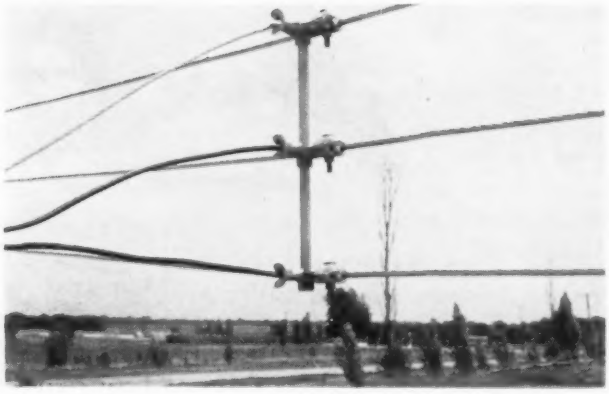
For complete information about the Hamilton RS-9, write to: Hamilton Watch Company, Hathaway Instrument Division, Denver, Colorado.

HAMILTON *WATCH COMPANY*
HATHAWAY INSTRUMENT DIVISION
5800 East Jewel • Denver, Colorado

New Equipment

Duplex Recorder . . .

. . . plots two related quantities side-by-side on a single chart. Known as the CH-37 Duplex recorder, the device occupies ⅓ less space than is required for a pair of synchronously operated CH-1 single element recorders performing the same function. The double record on a single roll permits faster reading and helps eliminate possible reading errors associated with matching separate charts.
General Electric Co, Schenectady 5, N. Y.

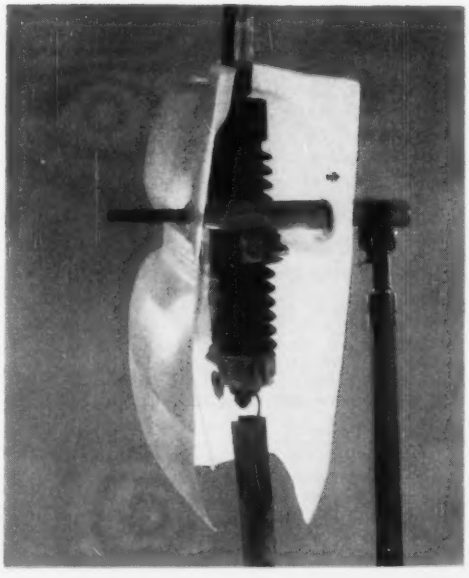


Insulated Spacer Bracket . . .

. . . helps make mid-span service taps. It is available in two models—one with 8-in. spacings to accommodate open-wire secondaries, and the other with 4-in. spacings for aerial cable. The bracket employs the contact-contour design of parallel-groove clamps. Castings are of a light weight, heat treated aluminum; spacer rods are of fiberglass. Castings are designed to prevent rain water from draining from secondary to tap.
A. B. Chance Co, Centralia, Mo.

Cutout Cover . . .

. . . can be easily positioned and removed by hotstick. The Universal Cover, of clear plastic, is designed for the 7.5-8 class, open type, single-insulator fused cutouts. It not only covers the current models of major manufacturers, but also covers many older models. It insures complete protection in all kinds of weather and temperatures from —40C to 170C. The cover weighs less than 3¼ lb and is extremely rugged.
Starline Co, 119 Franklin St, Dayton 2, Ohio.



(More Equipment on page 72)

NEW... and Improved MIF Pole Hardware

STRONGER, More Durable Installations at LESS COST

***NEW 11-SECTION CATALOG** contains 8 product group sections . . . 8 new catalogs in one . . . more than a catalog, a complete working manual with product description, application data and installation procedures.*

VERSATILITY-ECONOMY . . . Improved design and new developments in MIF Pole Hardware make MIF proven advantages and economies more widely applicable than ever before. More than 39 new designs in framing hardware for all types of wood structures, new aerial cable hardware, new guy and dead end attachments . . . these and many others are featured in the new MIF catalog.

STRONG-CORROSION RESISTANT . . . All designs, old and new, are of strong, tough, shock and corrosion resistant Malleable Iron. Curved and vari-planed surfaces, ribs and projections, smooth fillets, optimum distribution of material, all obtained in one casting operation, give better performance and exceptionally long life.

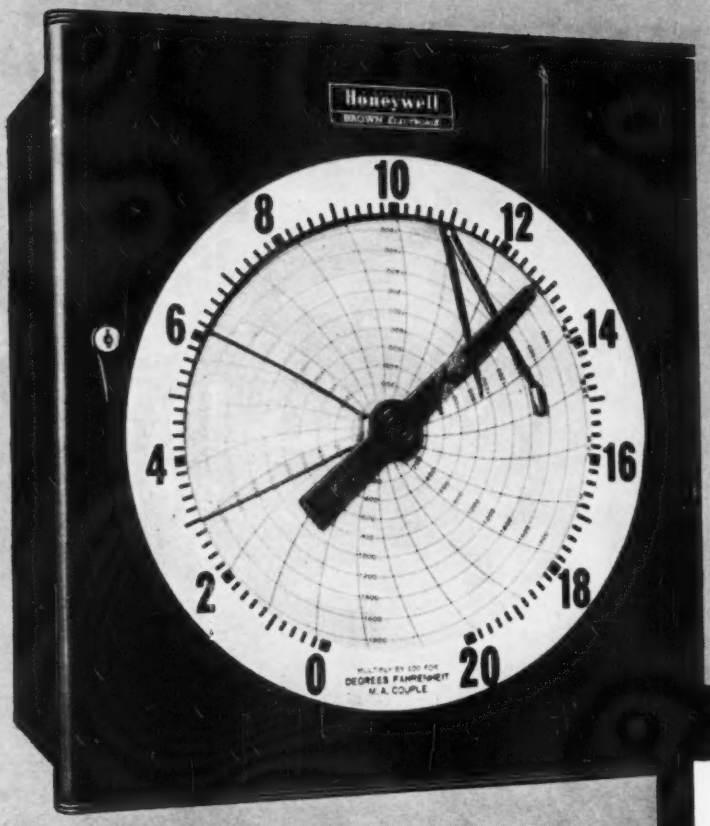
EASY INSTALLATION . . . An important characteristic of all designs is ease and simplicity of mounting (no special tools required), keeping installation costs to a minimum.

POLE HARDWARE DIVISION

Malleable Iron Fittings Company

BRANFORD • CONNECTICUT

RESEARCH • ENGINEERING • MANUFACTURING, FOR OVER 100 YEARS


Honeywell
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MULTIPLY BY 100 FOR
DEGREES FAHRENHEIT
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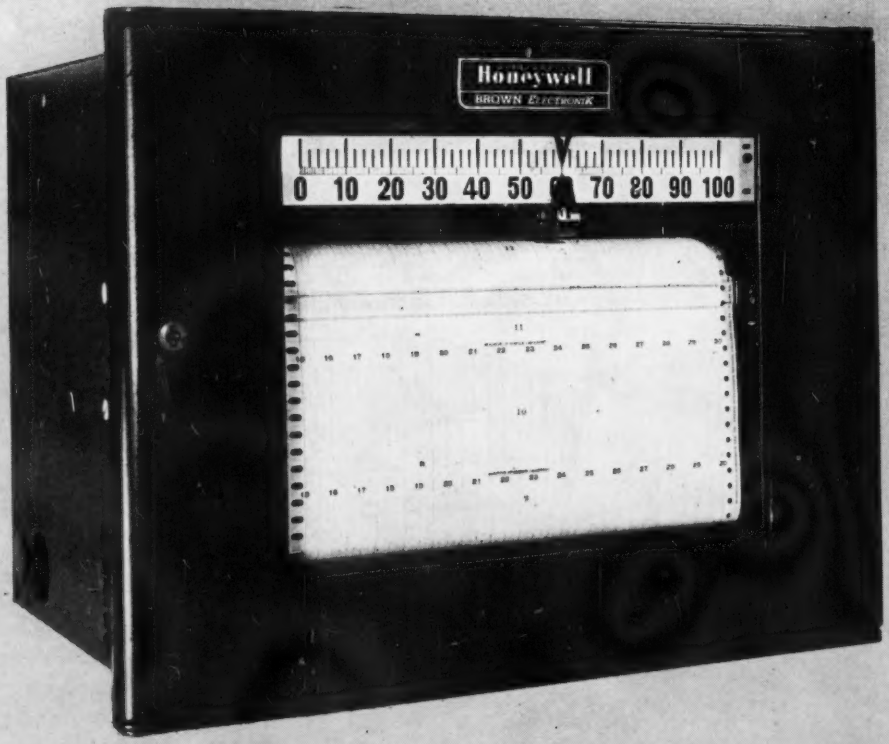
Honeywell
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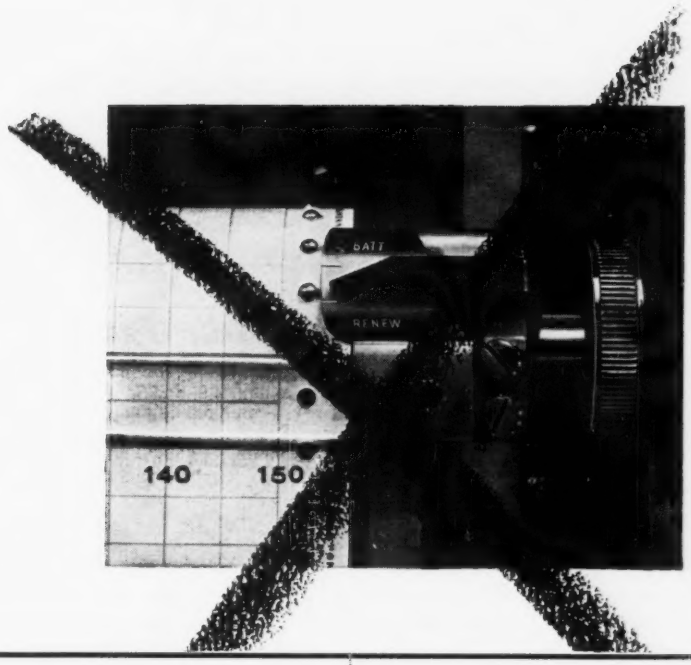


NO BATTERIES OR STANDARD CELLS

in *ElectroniK* potentiometers

The new Honeywell Continuous Voltage Stabilizer makes batteries, standard cells, and standardizing mechanisms unnecessary in new Brown *ElectroniK* circular or strip chart potentiometers. This new unit accurately regulates the D-C reference voltage supply to the measuring circuit. Standardization is no longer necessary.

The small, compact stabilizer unit uses Zener diodes and an ambient temperature compensator to deliver a constant rectified voltage from line supply. This assures uninterrupted response to changes in the measured variable.

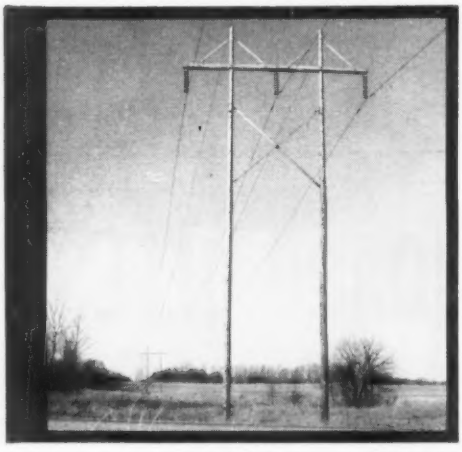
The Continuous Voltage Stabilizer means more dependability, less maintenance, continuous attention to the measured variable, and still another reason why *ElectroniK* instruments are your best value in measurement and control. Get full details from your nearby Honeywell field engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Control*

GALVANIZED STEEL STRAND

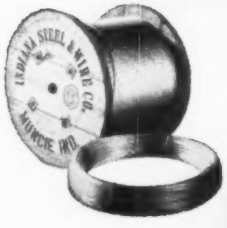


YOUR ASSURANCE OF HIGH QUALITY, LONG LIFE AND LOW COST

Close laboratory control over each step in manufacture has established Crapo Galvanized Steel Strand as a product of highest quality and dependability. You benefit through longer service life and lower ultimate costs.

Heavy, uniform, tightly-bonded coatings of commercially pure zinc, applied by the famous Crapo methods, withstand the punishment of construction, provide maximum resistance to corrosion and contribute to over-all economies.

For OVERHEAD GROUND WIRE . . .
CRAPO Weldless Galvanized Steel Strand



The most practical and economical strand for shielding transmission lines against lightning. Maximum strength and high fatigue endurance, inherent in Crapo Weldless Strand, provide that extra safety factor so important in overhead ground or static wire.

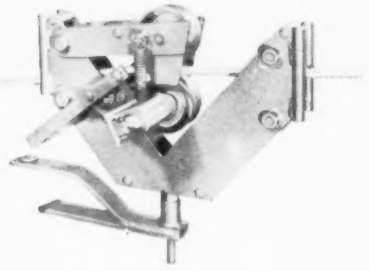
For GUYS and MESSENGER . . .
Crapo Galvanized Steel Strand. Made to highest standard specifications . . . a size and breaking strength to meet all practical needs.

Contact your jobber or write for descriptive folder.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

Potentiometer . . .

. . . contains continuous voltage stabilizer that eliminates batteries, standard cells and standardizing mechanisms. The stabilizer accurately regulates the dc reference voltage supply to the measuring circuit, making standardization unnecessary. It has a power supply consisting of a transformer, rectifier and a filter (capacitor and resistor) and a regulator with temperature-compensated output.
Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Windrim Aves, Philadelphia 44, Pa.



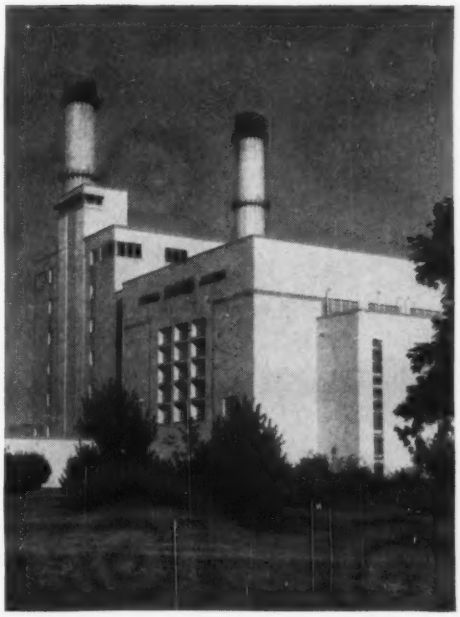
Footage Meter . . .

. . . measures wide range of cable sizes. The meter will also measure lead-coated and flexible conduit, wire rope, hose and plastic flexible pipe, in sizes ranging from ⅛ to 1¾-in. diameter. The measuring roll and its opposite roll are mounted on spring-loaded, pivoted arms. This enables the measuring roll to maintain continuous contact with the cable being run, even if the cable contains deformities.
Reel-O-Matic Div, Columbia Products, Inc, Wrightsville, Pa.

Fluorescent Lamp . . .

. . . produces 15% more light while consuming only 7% more power. An improved version of the Power-Groove lamp, the new design involves grooves along opposite sides of the tube, rather than along one side only. Weight of the lamp is reduced by nearly one quarter, making it easier to handle. It will be available in 4, 6 and 8-ft lengths.
General Electric Co, Nela Park, Cleveland 12, Ohio.

Only Exide gives you so broad a "choice"

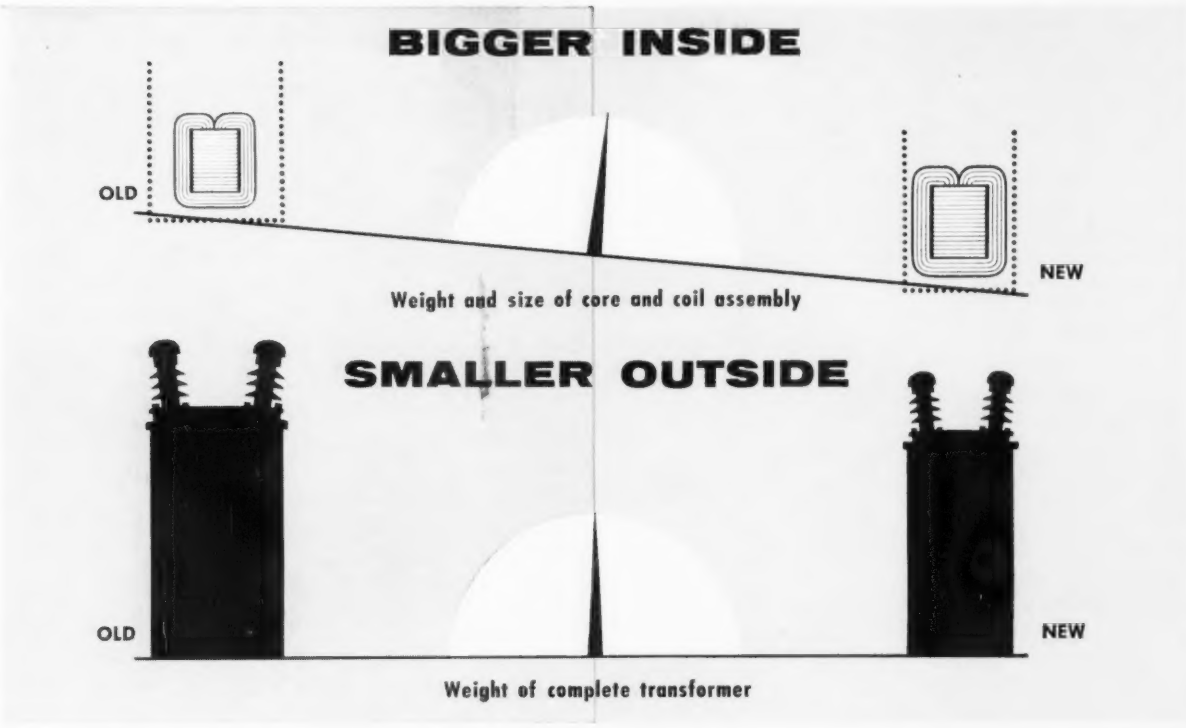


Exide-Tytex Batteries with Silvium grids were chosen by Rochester Gas & Electric Company for its Russell Station (shown above), Rochester, N.Y. Silvium is Exide's patented grid alloy proved up to 100% more corrosion resistant.

. . . in stationary batteries. What's your objective: long battery life, low initial cost, high current discharge, quick recharge? With Exide, you're free to choose. If you want a particular type of battery—plante, flat plate, calcium grid—Exide can supply it in a wide range of capacity ratings for any application. Because you have so broad a choice, you can select the one battery that best meets your own requirements. Yet in every case you know you are getting the extra dependability and value only Exide offers. So no matter what type of stationary battery you want, buy with confidence. Buy Exide. Full line of rectifier and motor-generator chargers available to cover any application requirements.

For complete information on Exide stationary batteries, write for the new illustrated brochure. Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Exide®



Here's why you get more for your transformer dollars this year

NEW KUHLMAN DESIGNS ARE *BIGGER* INSIDE, *SMALLER* OUTSIDE

Larger core and coil, using more copper and steel, provide lower losses, improved impedance, and better regulation. A smaller tank takes up less room on the pole and offsets the increased size and weight of the stepped-up core and coil.

With the new Kuhlman '59 Transformer—bigger inside, smaller outside—Kuhlman engineers continue the advances begun with the Kuhlman "Bent Iron" Core. For more than a quarter-century, this has been the most-used principle, industry-wide, to achieve highest transformer efficiency at the lowest possible weight. With the improvement in steel, the Bent Iron Core has done more than any other single thing to make today's lightweight pole transformer possible.

"Bigger inside, smaller outside" is one of the reasons why Kuhlman's 65th year is a big year for you. This year, more than ever, you get more for your transformer dollar from Kuhlman.

Get all the facts from the Kuhlman representative near you.

ALL NEW INSIDE . . .

Conventional above 5KV | Conventional 5KV and below | CSP® | Rural

KUHLMAN ELECTRIC COMPANY

65

the year you get more for your transformer dollars

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich.

Plants at Bay City, Michigan; Crystal Springs, Mississippi; Salinas, California